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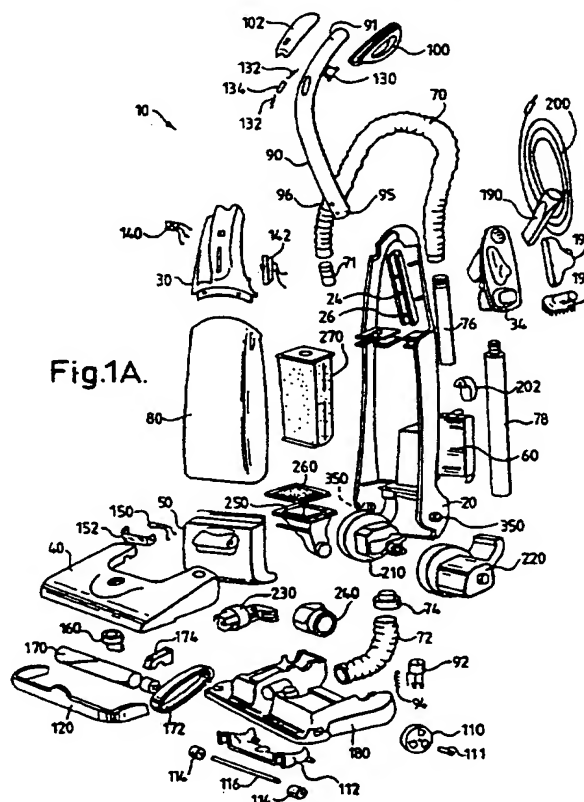
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(54) Abstract Title

**Self-propelled upright vacuum cleaner**

(57) A vacuum cleaner 10 comprises an upper housing 20 and a lower base unit 40 which are pivotally connected. A drive motor 230 and drive assembly 240, 110, 111 are provided in the base unit. A suction motor 210 is provided in either the base unit or the upper housing. The upper housing defines a suction chamber containing a bag filter 270 accessible via cover 80. A nested wand 78 is releasably attached to the exterior of the upper housing and is in communication with the suction chamber via hose 70. A thermal cutoff switch may be present to terminate operation of motor 210 if excessive operating temperatures are reached. A tilt switch may be provided in handle 90 to prevent operation of drive motor 230 when the handle is upright. Features of the airflow route and filters of the vacuum cleaner increase efficiency and allow quieter operation.



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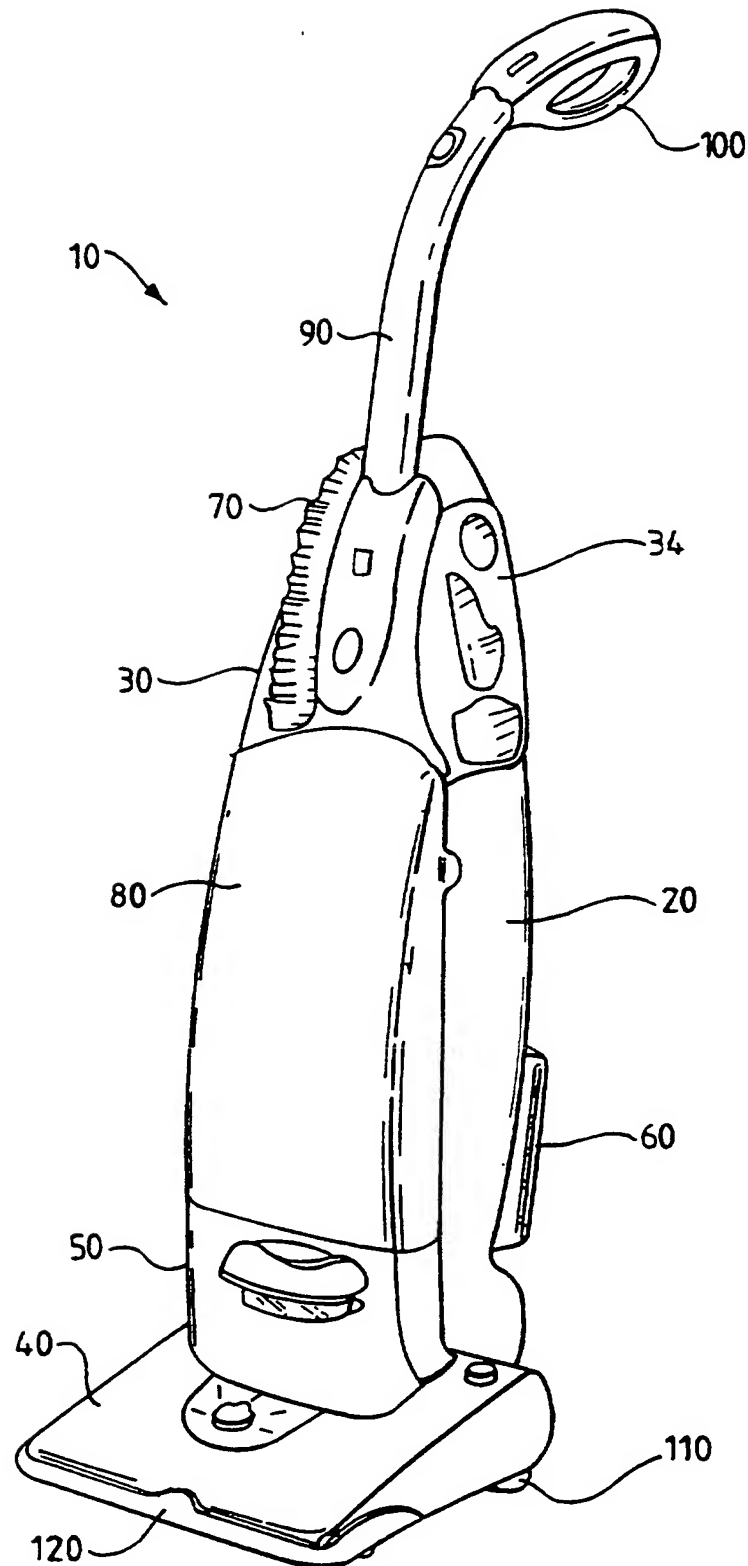


Fig.1.

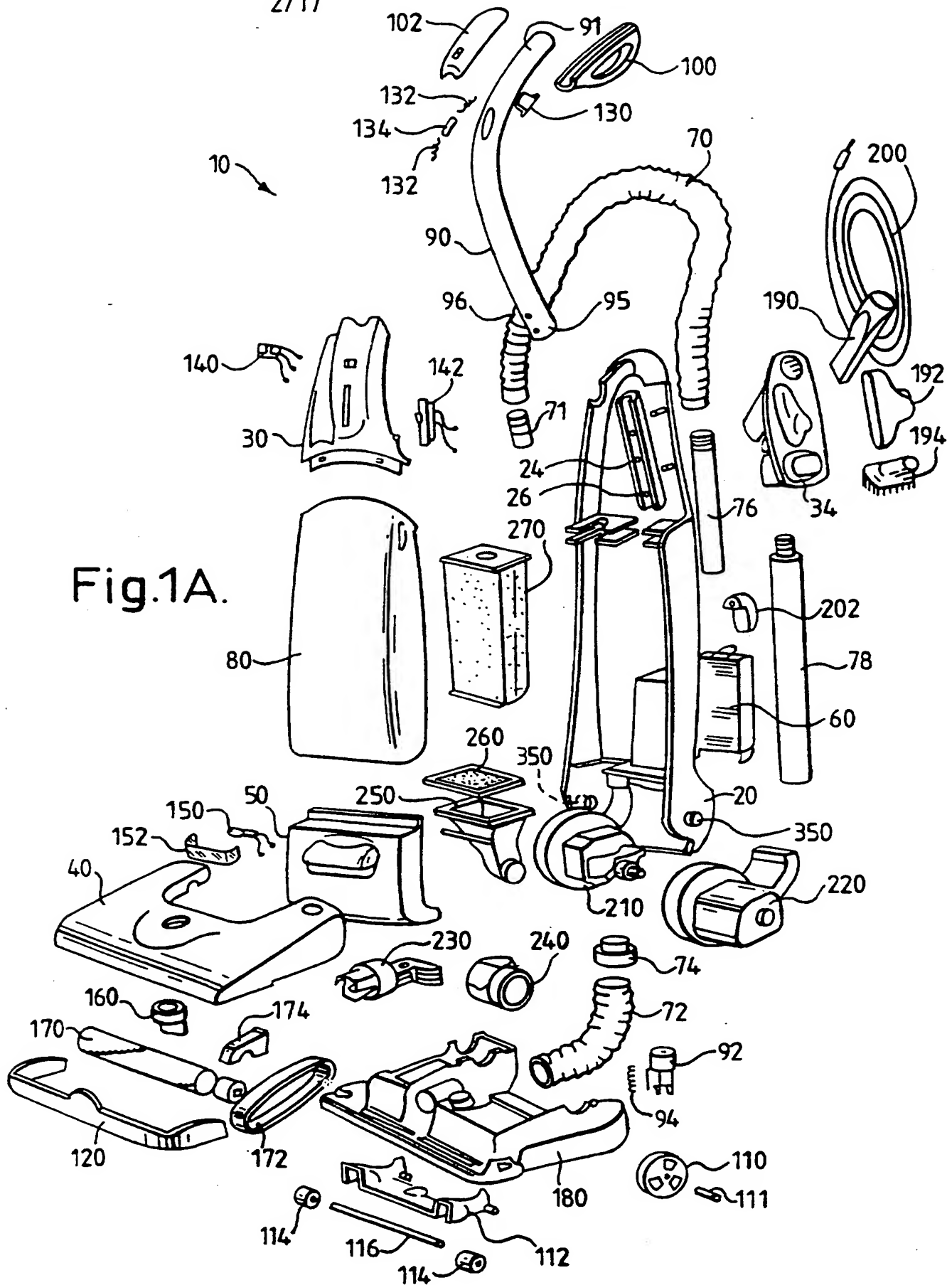


Fig.1A.

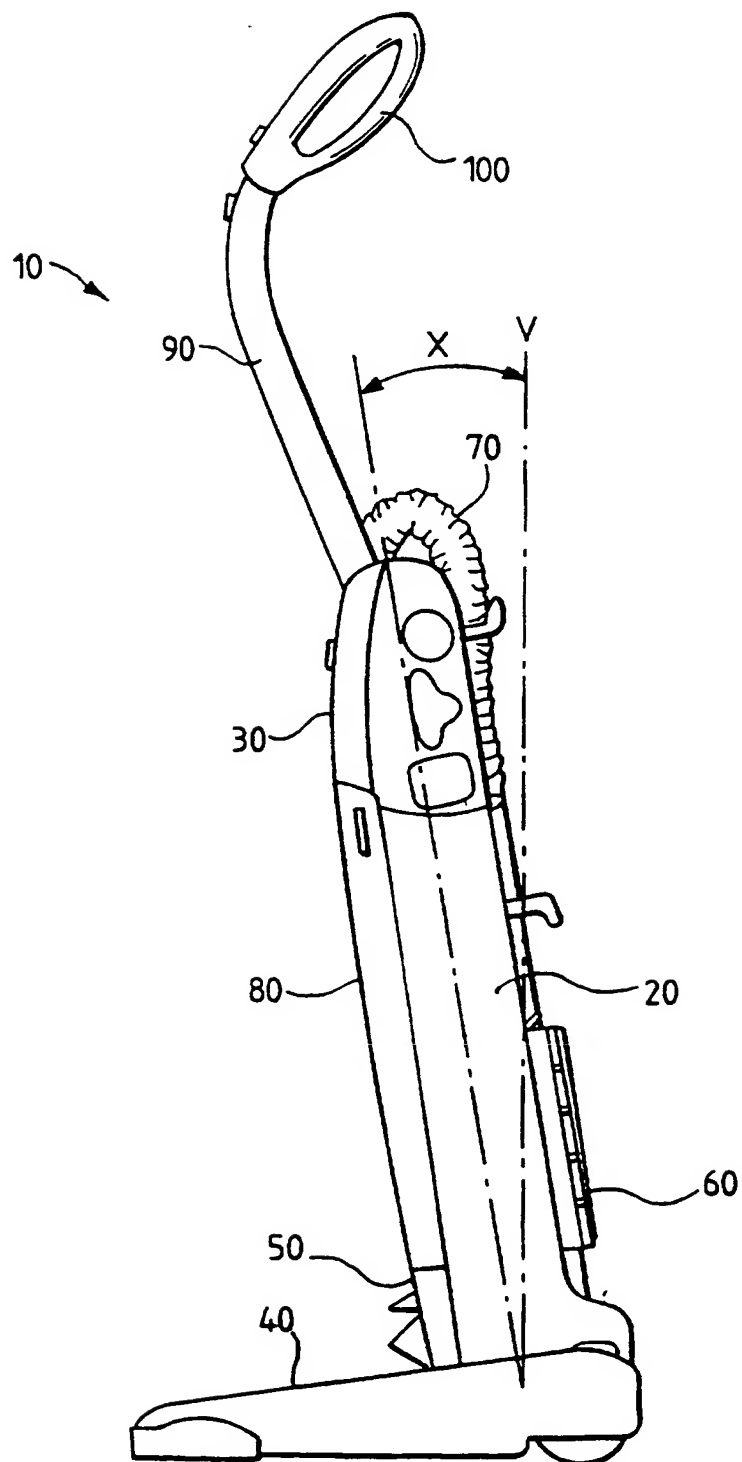


Fig.1B.

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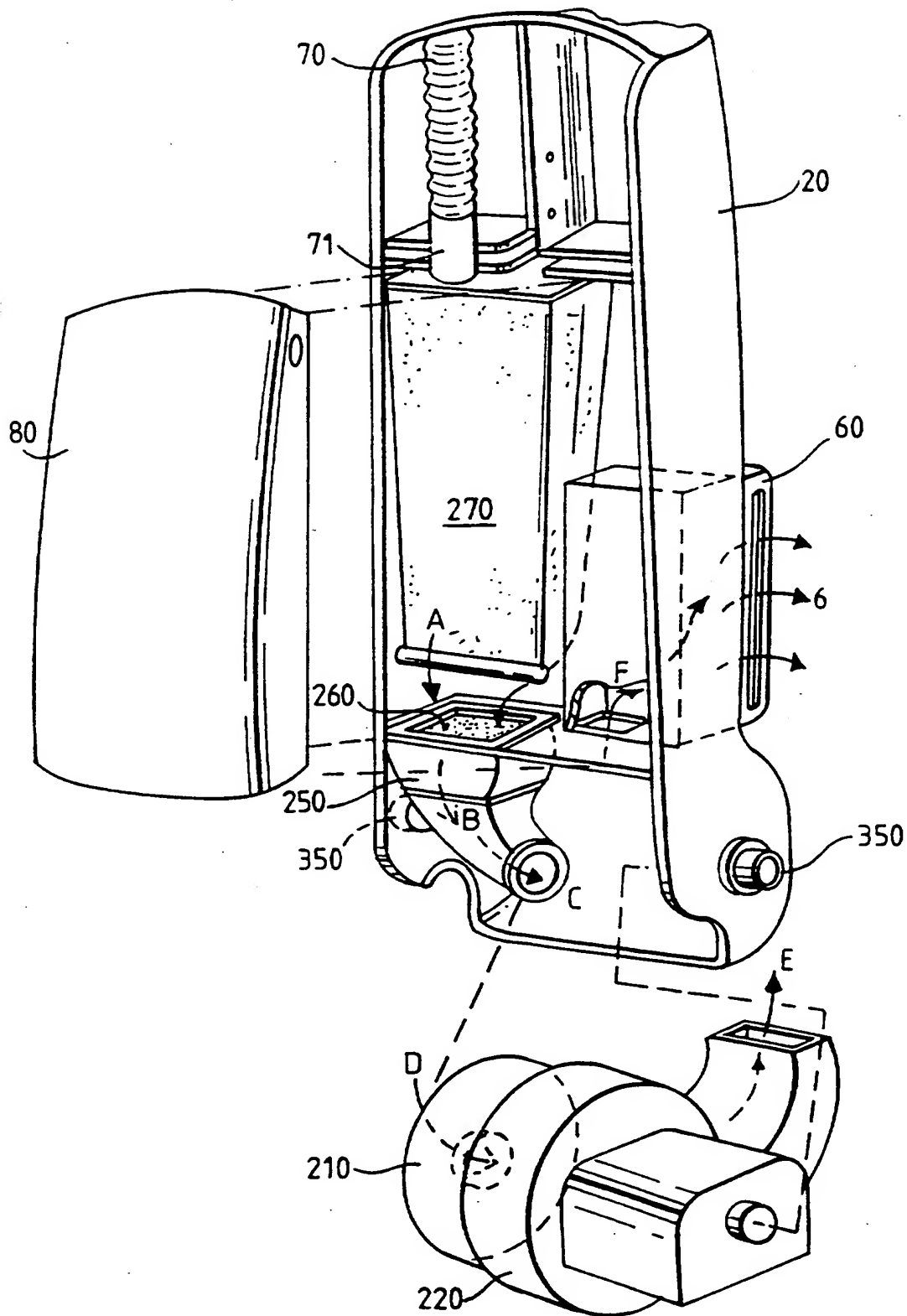


Fig.2.

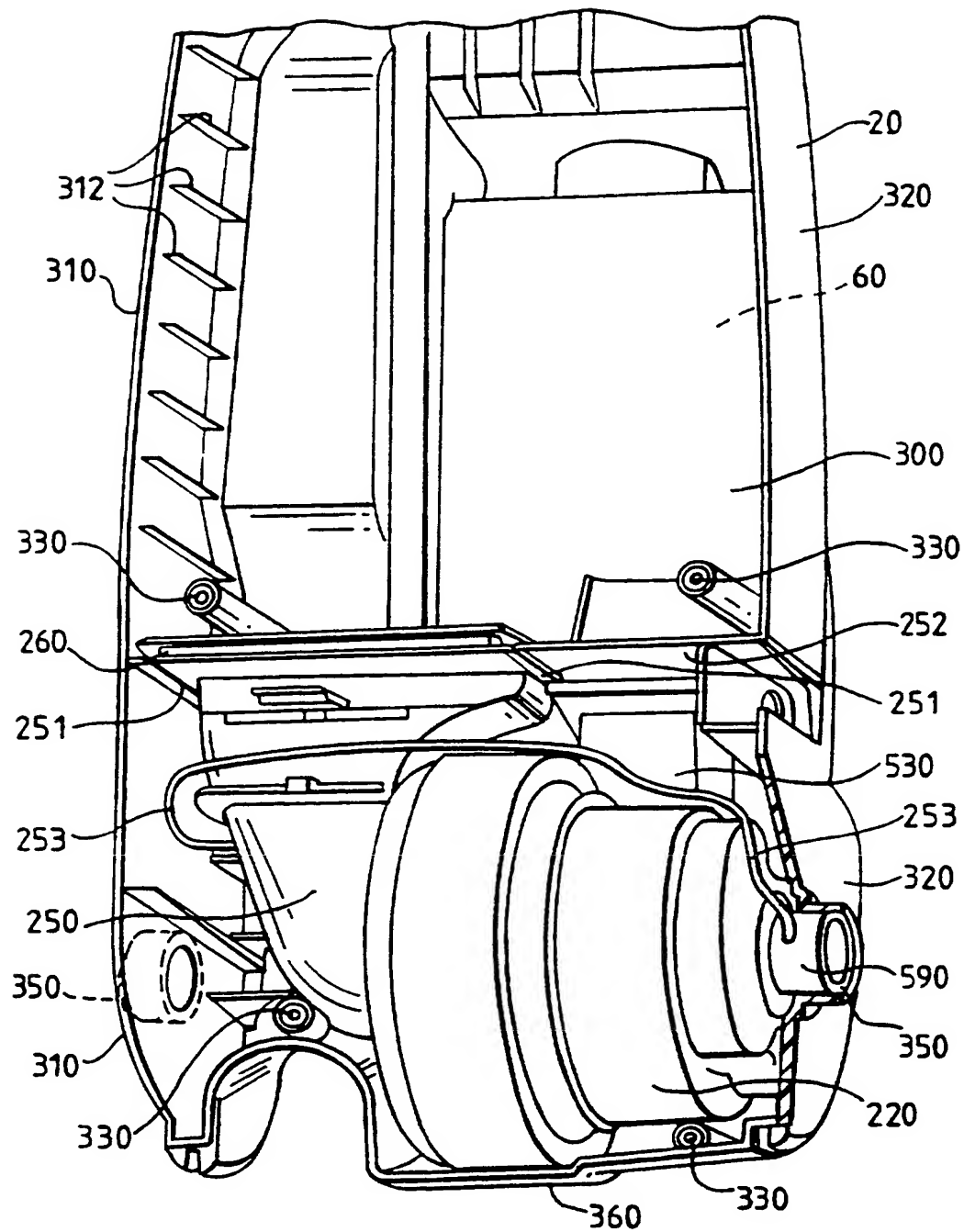


Fig.2A.

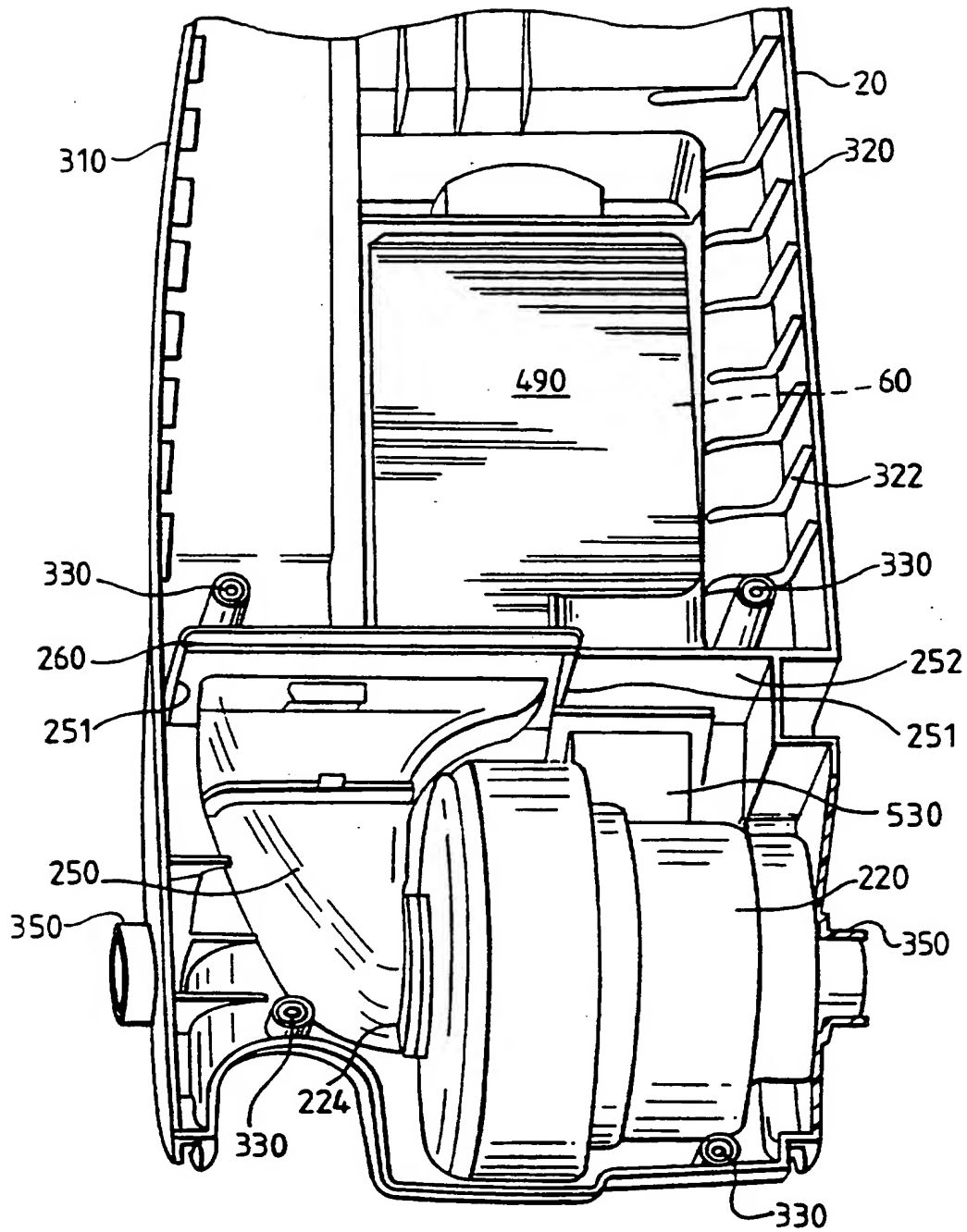


Fig.2B.

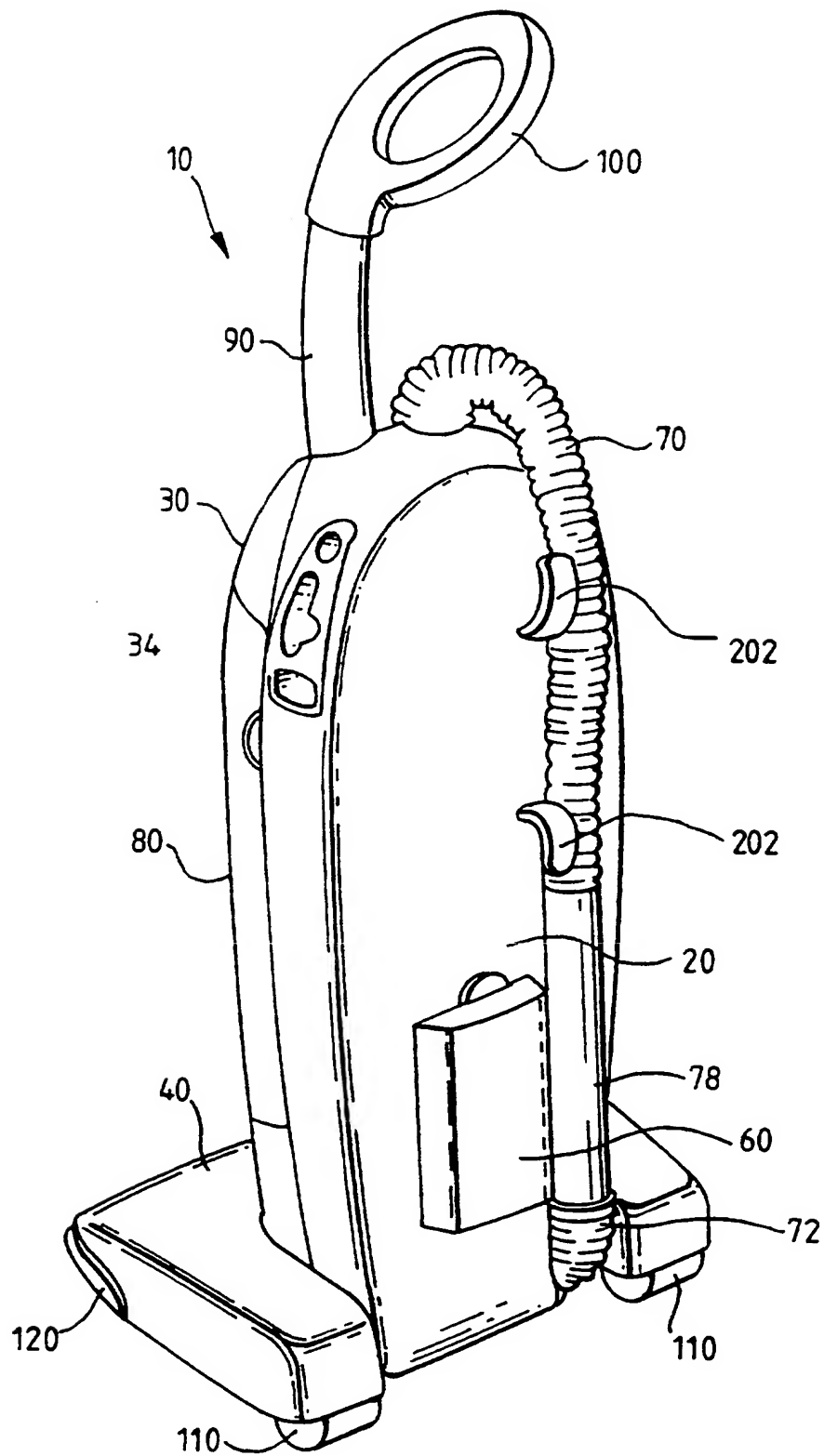


Fig. 3.



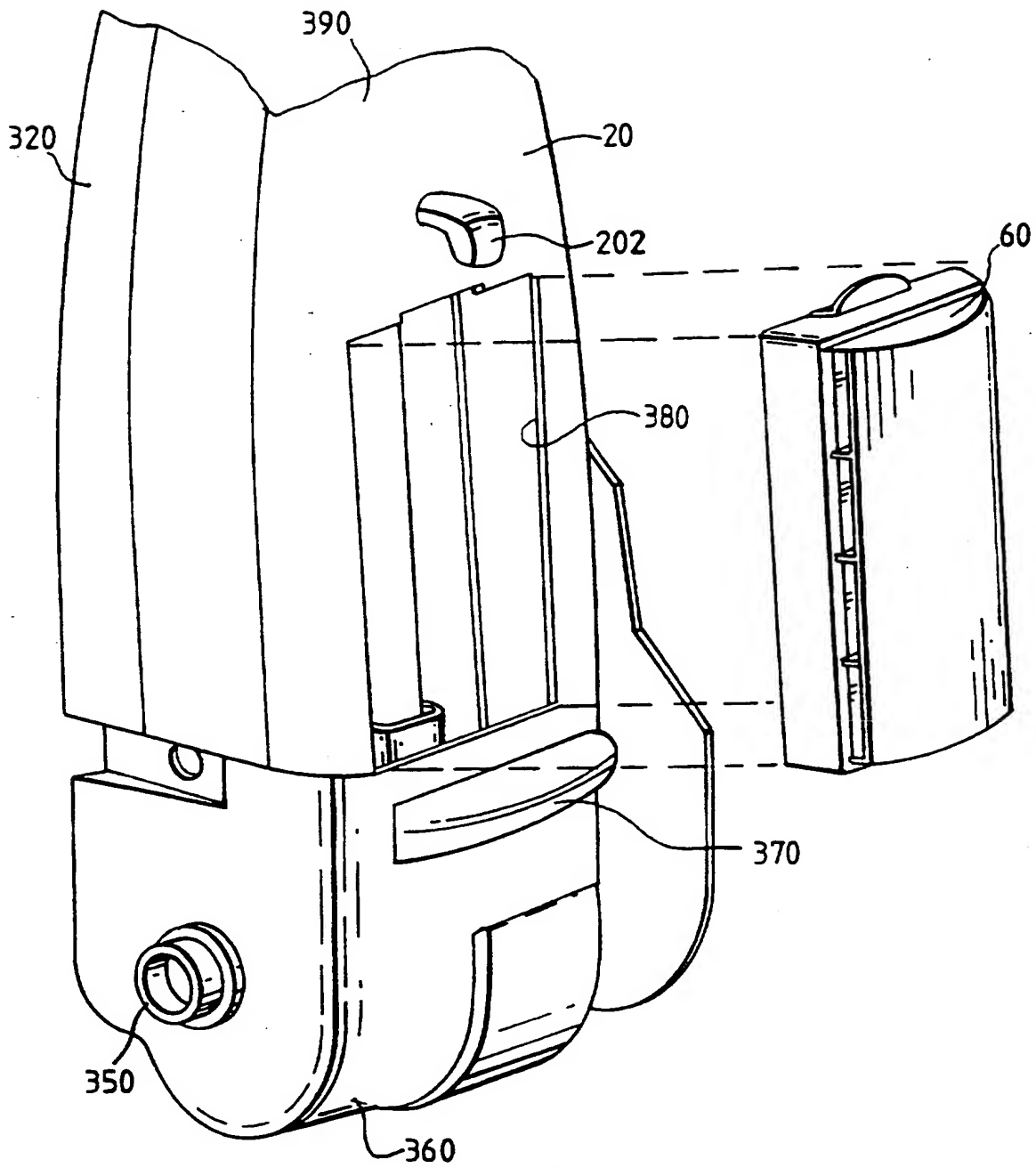


Fig.4.

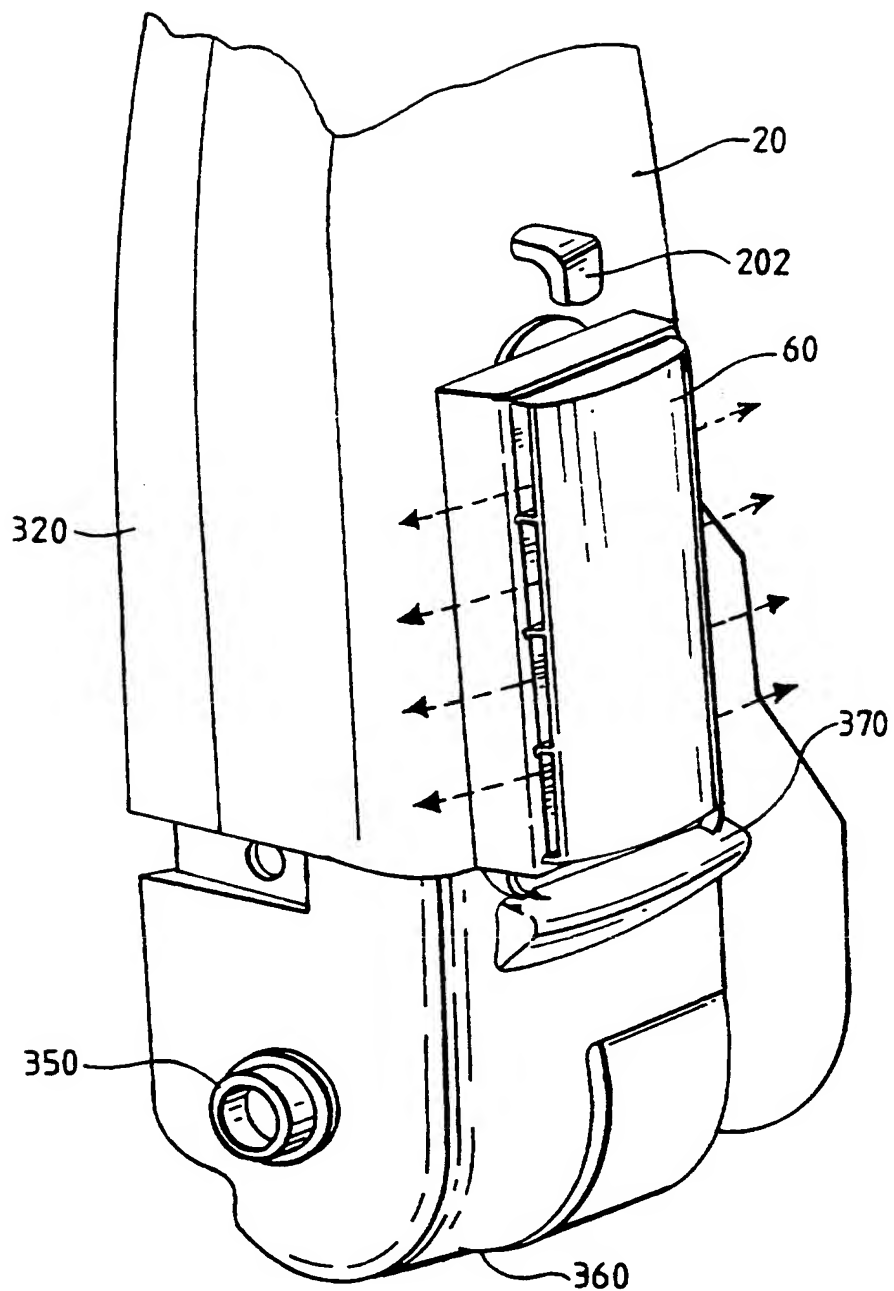


Fig.4A.

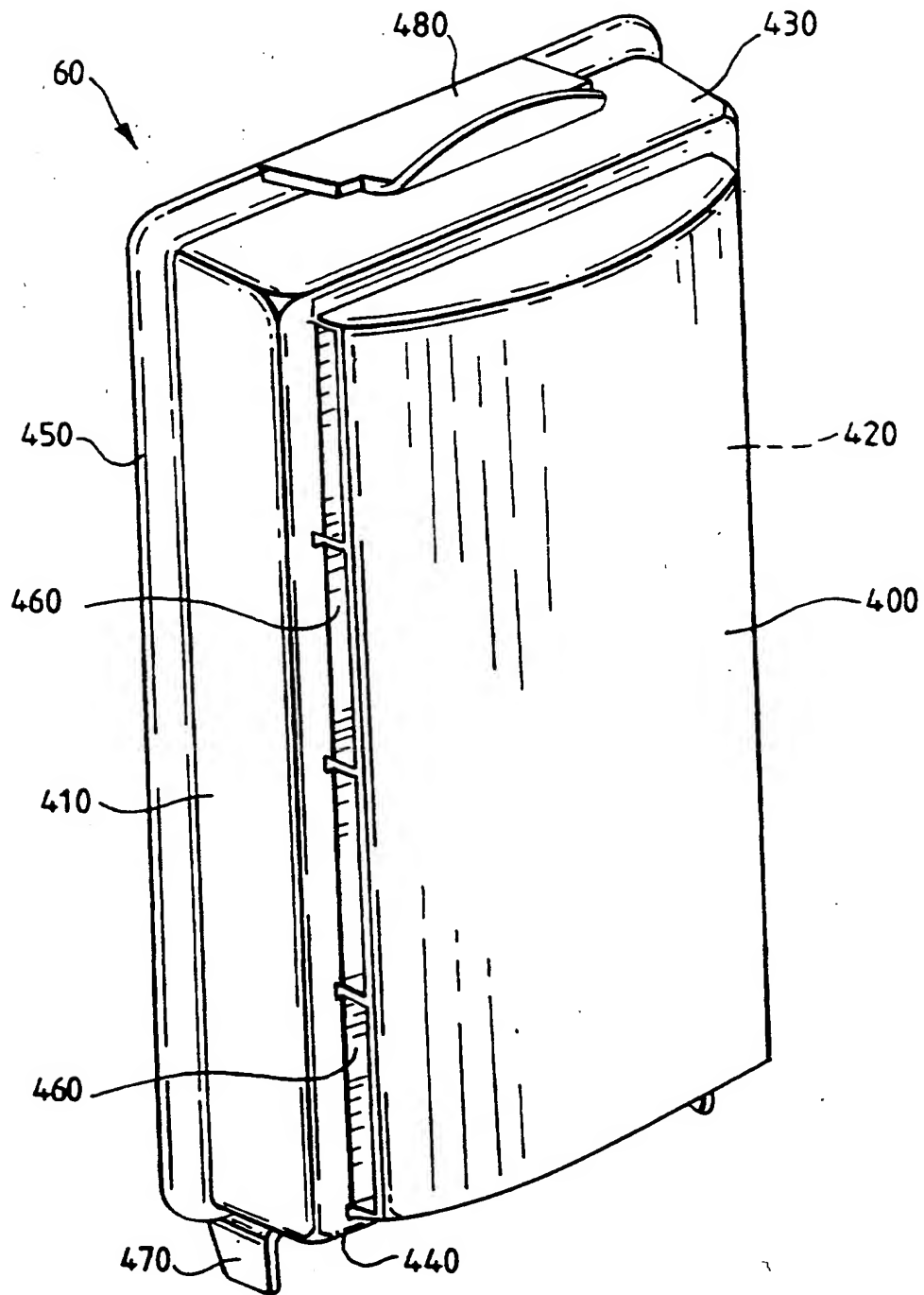


Fig.5.

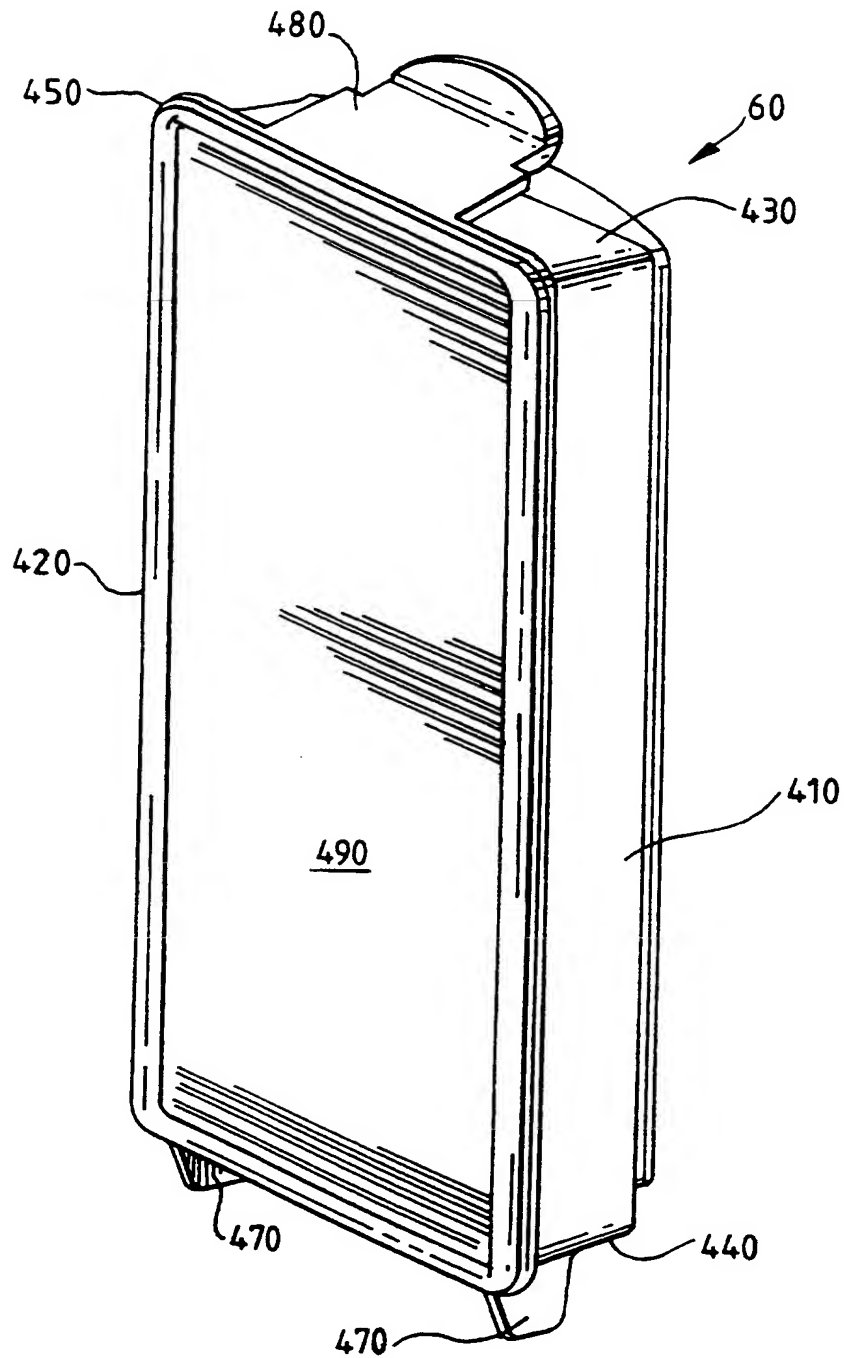


Fig.6.

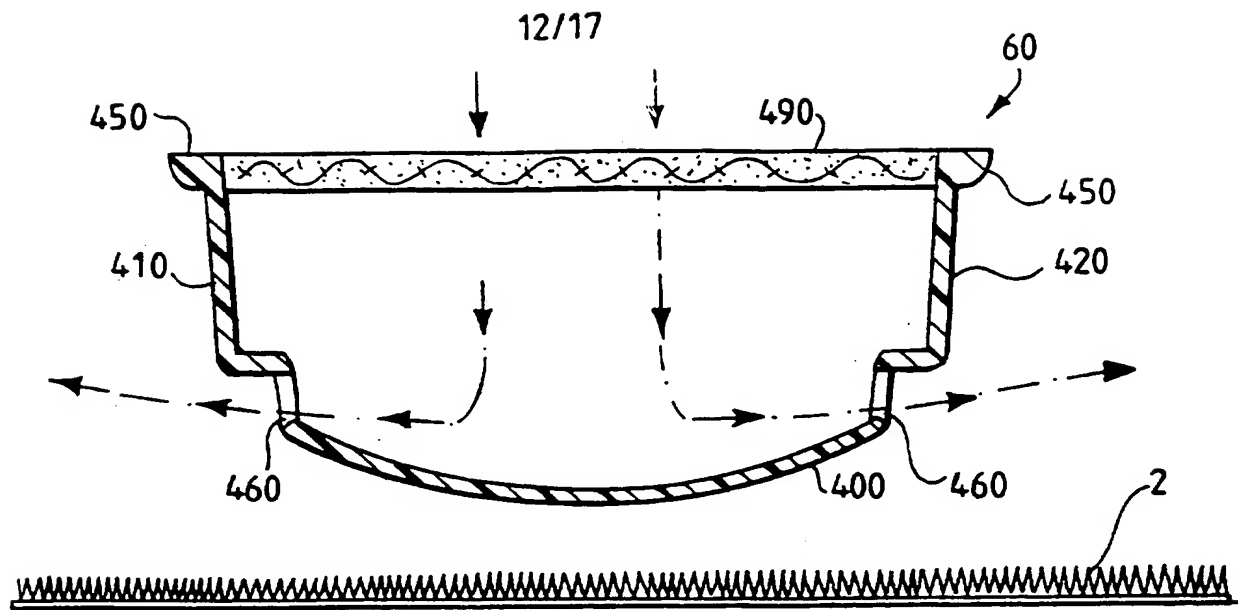


Fig.7.

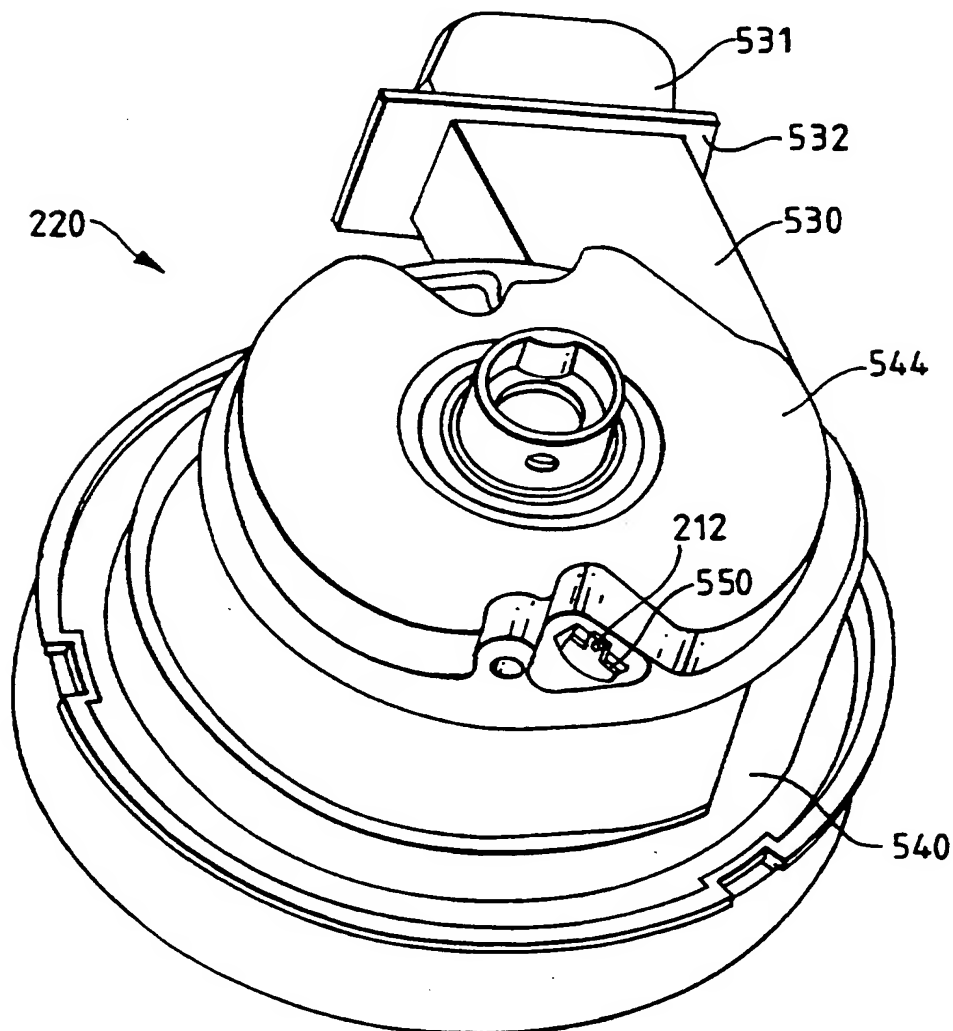


Fig.9.

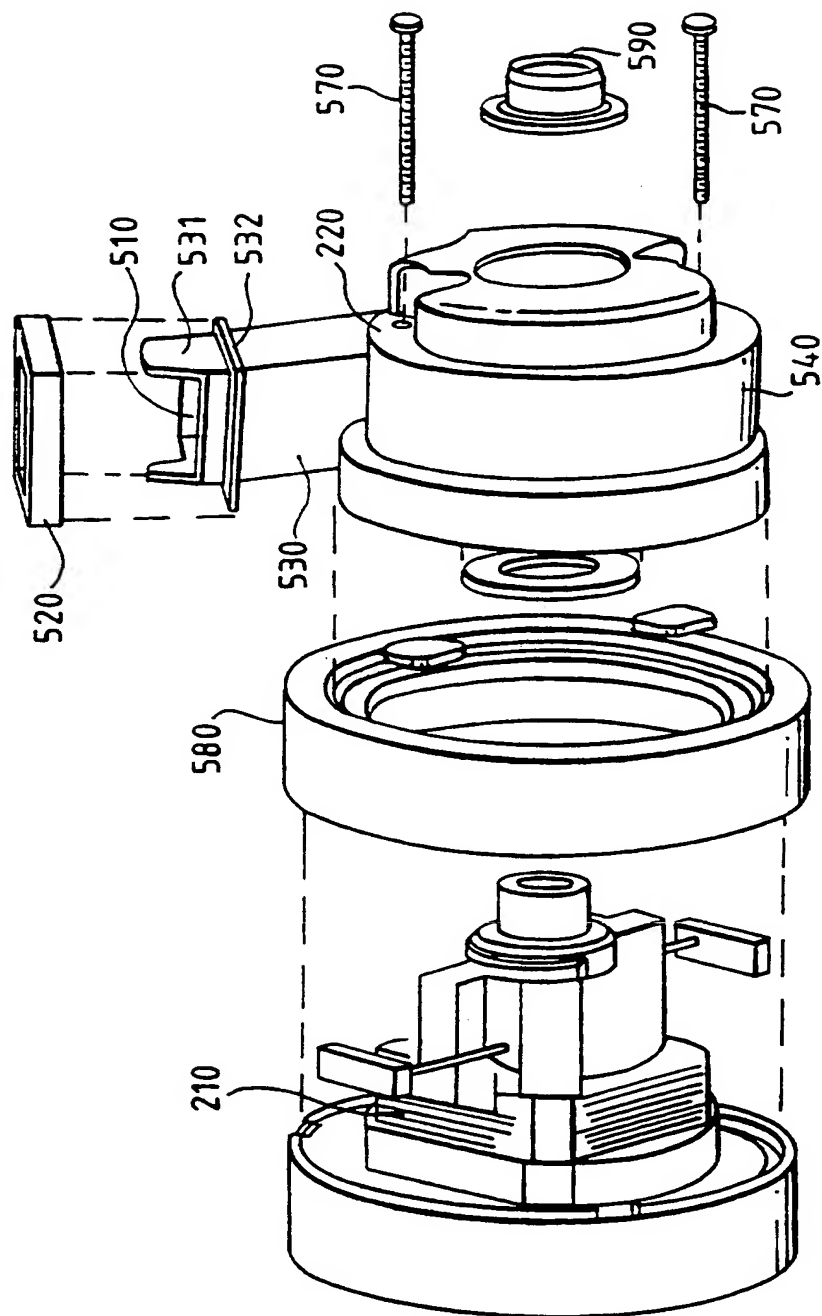


Fig.8.

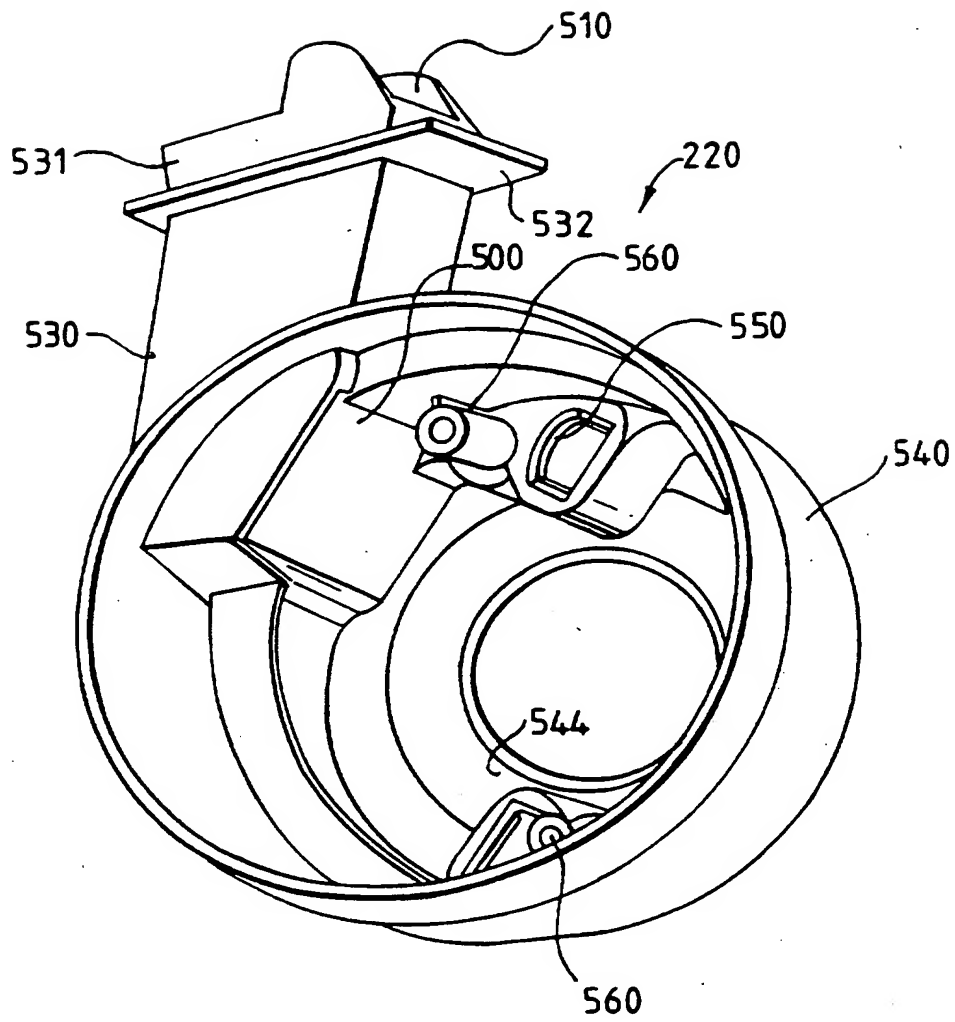


Fig.10.

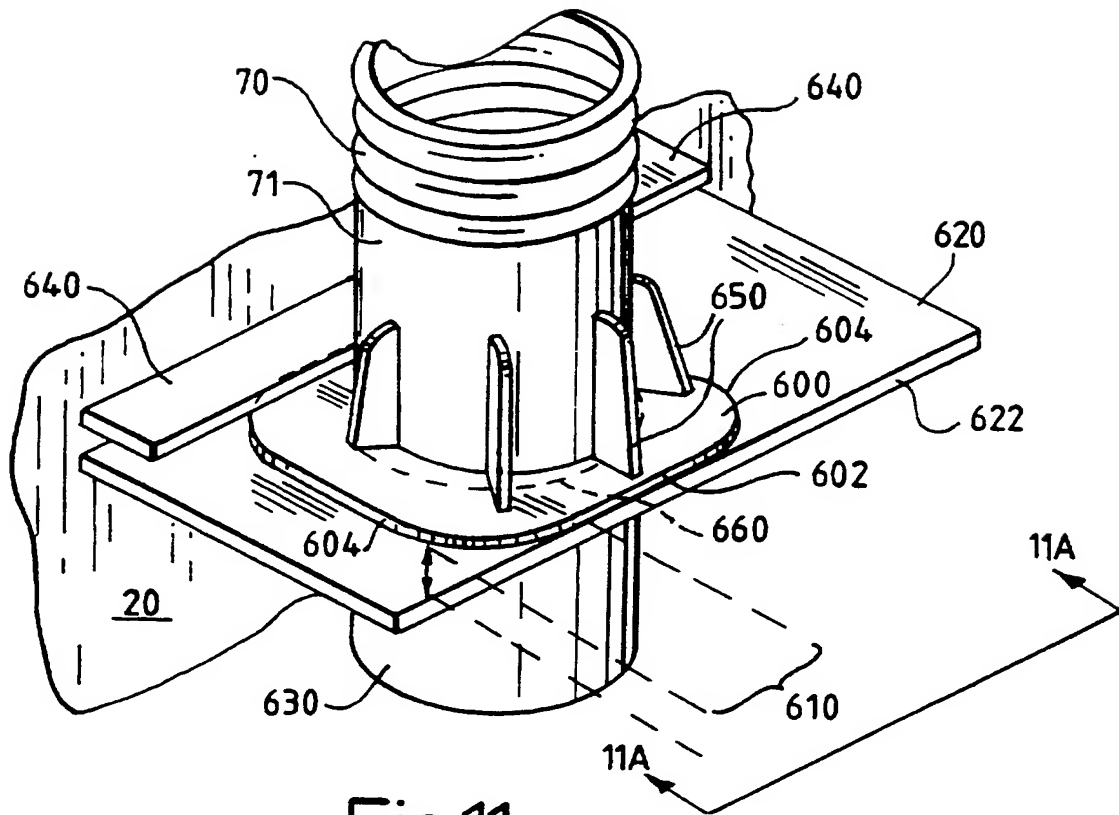


Fig.11.

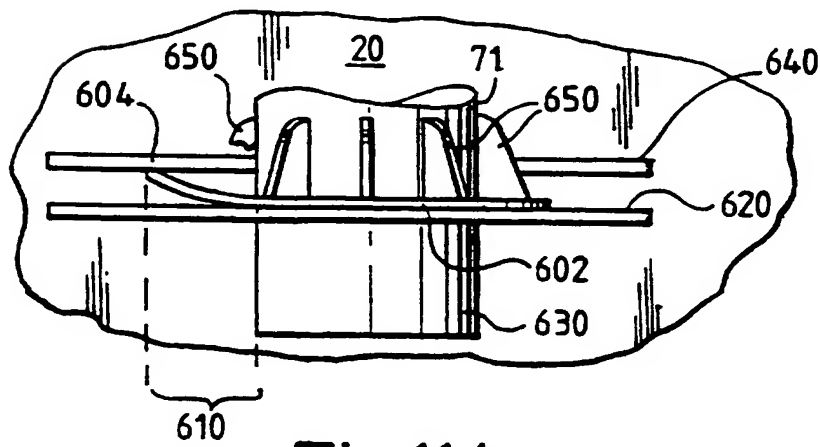


Fig.11A.



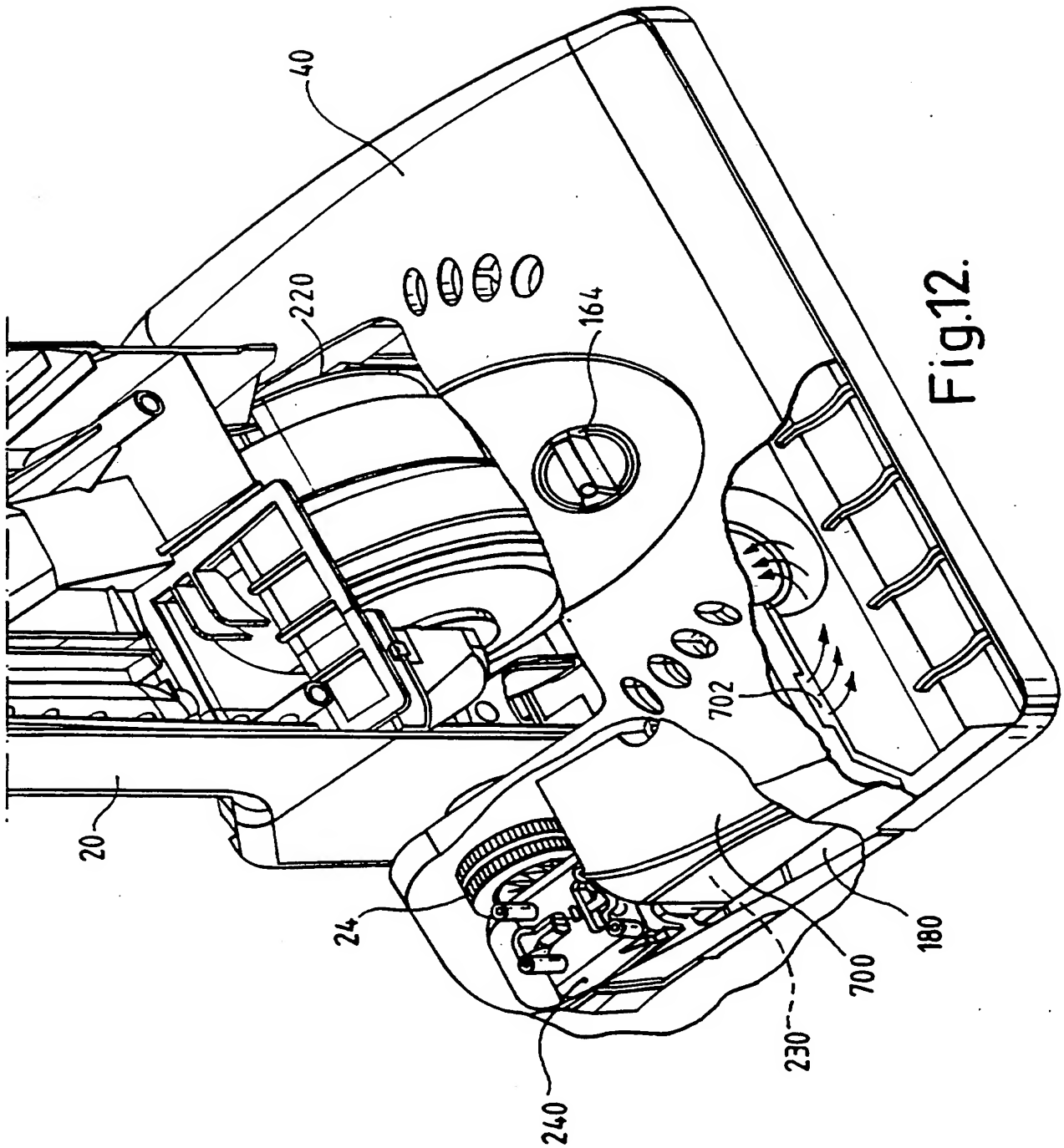


Fig.12.

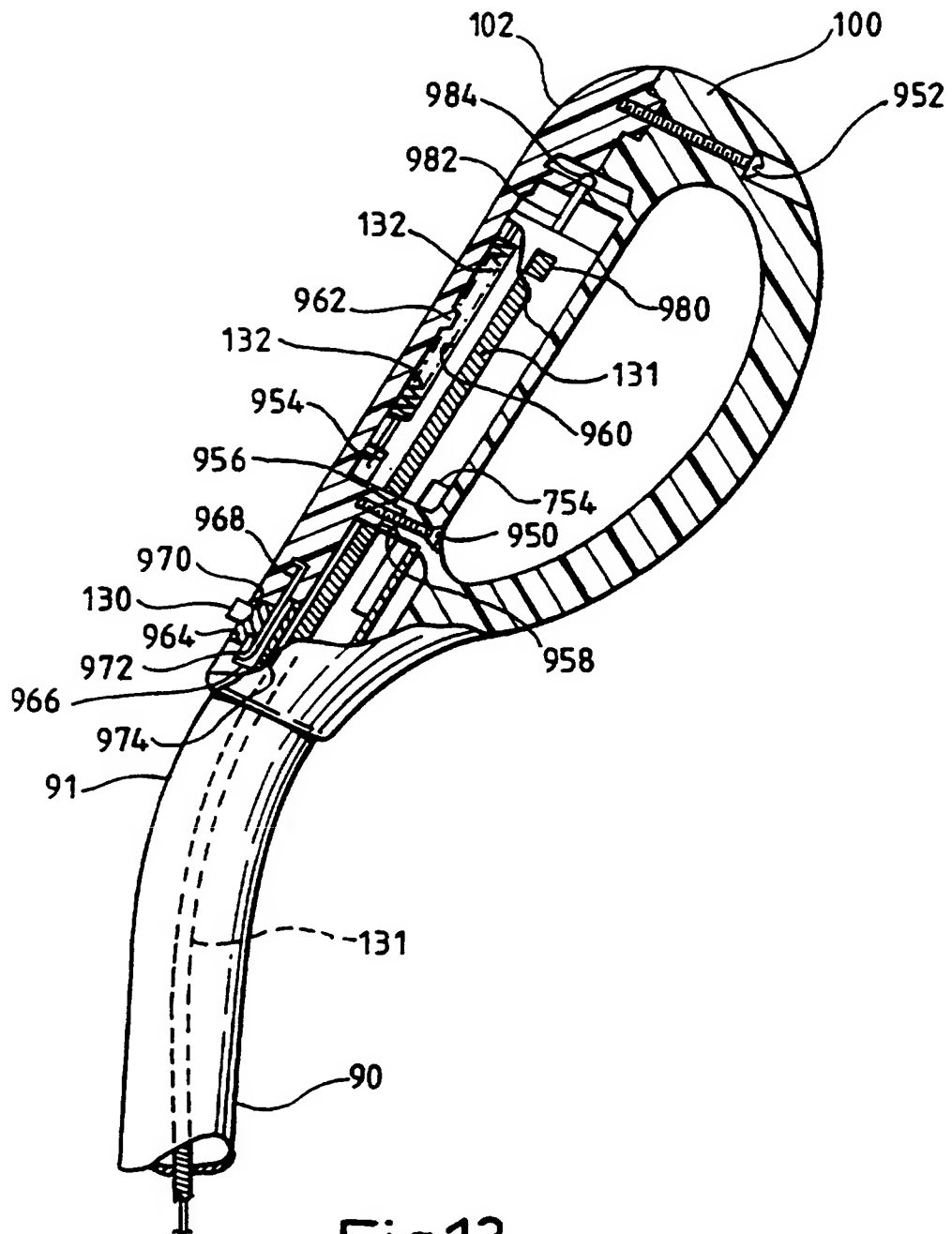


Fig.13.

## 1 AIR FILTRATING SELF-PROPELLED UPRIGHT VACUUM CLEANER

## 2 FIELD OF THE INVENTION

3 This application claims the benefit of U.S.  
4 Provisional Application No. 60/035,357, filed January 10,  
5 1997.

6 The present invention relates to a self-propelled  
7 upright vacuum cleaner comprising a unique HEPA-rated air  
8 filtration system. The present invention also relates to a  
9 self-propelled upright vacuum cleaner having a thermal cut-  
10 off circuit, a novel air routing configuration within the  
11 unit, and numerous other improvements and features.

12 There is an increasing emphasis upon the cleanliness  
13 of air discharged from vacuum cleaners. Prior artisans  
14 have attempted to provide secondary filters for vacuum  
15 cleaner exhaust air streams. Although satisfactory in most  
16 respects, most known secondary filtering configurations are  
17 difficult to design and incorporate within the vacuum  
18 cleaner, thereby increasing the complexity, manufacturing  
19 time, and cost of the unit. Furthermore, for assemblies  
20 employing replaceable filter elements, there is often  
21 considerable difficulty in replacing the element,  
22 particularly if it is located within the vacuum cleaner.  
23 Accordingly, there is a need for a vacuum cleaner  
24 comprising a secondary filtering assembly that overcomes  
25 the problems of the prior art. It would be particularly  
26 desirable to provide a vacuum cleaner with an easily  
27 replaceable filter element in combination with a sealed air  
28 path so that all air exiting the vacuum cleaner unit  
29 traveled through the filter prior to exiting the vacuum  
30 cleaner.

31 Air leaks from a vacuum cleaner unit, such as leakage  
32 of the exhaust stream around the motor housing into the  
33 environment, not only introduce particulates and  
34 contaminants into the outside environment and thus bypass

1 any secondary filter if so provided, but also decrease the  
2 overall efficiency of the unit. Thus, there is a need for  
3 a vacuum cleaner providing an improved internal air routing  
4 configuration which prevents or at least significantly  
5 minimizes exhaust air leaks in and around the lower  
6 enclosure, and particularly around the motor housing.

7 It is desirable to provide a sensor and electrical  
8 circuit to stop operation of the vacuum cleaner motor in  
9 the event that the temperature of the motor exceeds a  
10 predetermined temperature. Heating of the motor typically  
11 results from a blocked or plugged filter, or from one or  
12 more objects interfering with the operation of the rotating  
13 brush or floor element. Prior artisans have incorporated  
14 temperature sensors and motor switching circuits in vacuum  
15 cleaners. However, as far as is known, none of the known  
16 sensors and switching circuits utilized in vacuum cleaners  
17 provide an automatic reset feature. That is, all known  
18 vacuum cleaners with on board temperature sensors may be  
19 started immediately after the sensor sufficiently cools.  
20 Although satisfactory in most respects, this configuration  
21 still enables electrical power to be applied to the motor.  
22 This may result in damage to the motor, in the event the  
23 motor is bound or otherwise locked. Accordingly, there is  
24 a need for an improved temperature sensing and motor  
25 interlock circuit whereby a reset operation is performed to  
26 ensure that electrical power is not inadvertently directed  
27 to a locked motor.

28 Self-propelled vacuum cleaners are known. However,  
29 much of the design and engineering efforts directed to such  
30 units are focused upon the drive assembly and vacuuming  
31 function. There remains an opportunity to improve other  
32 aspects of self propelled vacuum cleaners such as their  
33 noise level, electrical safety considerations, life of  
34 components such as the motor bearings, connections for an  
35 accessory hose, and configuration of the operator handle.

## 36 SUMMARY OF THE INVENTION

37 The present invention achieves all the foregoing

1 objectives and provides in a first aspect, a vacuum cleaner  
2 comprising a housing and a base unit pivotally attached to  
3 each other, a motor and motor housing disposed within the  
4 base unit, a drive assembly also disposed within the base  
5 unit and selectively coupled to the motor, a nested wand  
6 releasably retained along the exterior of the housing, a  
7 lower air conduit extending between the base unit and a  
8 lower end of the wand, and an upper air conduit extending  
9 between an upper end of the wand and a suction chamber  
10 defined within the housing.

11 In another aspect, the present invention provides a  
12 vacuum cleaner comprising a lower base unit, an upper  
13 pivotable enclosure for housing a filter bag, a motor  
14 disposed within the lower base unit, a power cord and  
15 associated electrical conductors defining an electrical  
16 power circuit to the motor, and a thermal cutoff assembly  
17 including a temperature sensor disposed proximate to the  
18 motor for measuring the temperature of the motor, the  
19 thermal cutoff assembly including a switching element in  
20 the electrical power circuit that opens upon the  
21 temperature sensor sensing a temperature greater than a  
22 predetermined temperature setpoint.

23 In yet another embodiment, the present invention  
24 provides a vacuum cleaner comprising a lower base unit, an  
25 upper enclosure for retaining a filter bag, the upper  
26 enclosure defining a suction chamber, and exhaust chamber,  
27 and an exhaust opening providing access from the exterior  
28 of the upper enclosure to the exhaust chamber, a motor and  
29 fan assembly disposed within the upper enclosure and in  
30 airflow communication between the suction chamber and the  
31 exhaust chamber, and a detachable filter assembly that  
32 releasably engages the upper enclosure at or near the  
33 exhaust opening.

34 In yet another aspect, the present invention provides  
35 a vacuum cleaner comprising a lower base enclosure, an  
36 upper enclosure having internal walls dividing the upper  
37 enclosure into a suction chamber, an exhaust chamber, and a  
38 motor chamber, a motor and fan assembly disposed in a

1 shroud which resides in the motor chamber, an air intake  
2 duct extending between the suction chamber and the shroud.  
3 The air intake duct engages either or both the suction  
4 chamber and the shroud along an unsealed interface.  
5 According to a further aspect of this invention a  
6 motor and transmission module selectively powers a base  
7 drive wheel and at least the motor of the module is encased  
8 in a shroud. The shroud is connected by an exhaust  
9 passageway to the air flow path leading ultimately to the  
10 final filter.

11 BRIEF DESCRIPTION OF THE DRAWINGS

12 FIG. 1 is a perspective view of a preferred embodiment  
13 vacuum cleaner in accordance with the present invention;

14 FIG. 1A is an exploded view of the preferred  
15 embodiment vacuum cleaner illustrated in FIG. 1;

16 FIG. 1B is a side elevational view of the preferred  
17 embodiment vacuum cleaner illustrated in FIG. 1;

18 FIG. 2 is a partial exploded view of the preferred  
19 embodiment vacuum cleaner housing, illustrating in greater  
20 detail the direction of airflow within the housing;

21 FIG. 2A is a detailed view of the assembled housing  
22 shown in FIG. 2 having a bag cover removed;

23 FIG. 2B is another view of the housing shown in FIG. 2  
24 with the bag cover removed;

25 FIG. 3 is a perspective view of the rear of the  
26 preferred embodiment vacuum cleaner;

27 FIG. 4 is a detailed view illustrating the affixment  
28 of a preferred embodiment detachable filter to the rear  
29 housing of the preferred embodiment vacuum cleaner;

30 FIG. 4A illustrates the filter shown in FIG. 4  
31 attached to the rear housing and the direction of airflow  
32 from the preferred embodiment vacuum cleaner;

33 FIG. 5 is a detail of the preferred embodiment filter  
34 used in the preferred embodiment vacuum cleaner;

1           FIG. 6 is another view of the preferred embodiment  
2 filter;  
3           FIG. 7 is a schematic cross-sectional view of the  
4 preferred embodiment filter illustrating its orientation to  
5 the floor when the preferred embodiment vacuum cleaner is  
6 set to a fully reclined position;  
7           FIG. 8 is an exploded view of a suction motor and a  
8 motor shroud used in the preferred embodiment vacuum  
9 cleaner;  
10          FIG. 9 is a detailed view of the motor shroud shown in  
11 FIG. 8;  
12          FIG. 10. is another detailed view of the motor shroud  
13 shown in FIG. 8;  
14          FIG. 11 is a detailed view of the engagement between a  
15 hose adapter and the housing of the preferred embodiment  
16 vacuum cleaner;  
17          FIG. 11A is an elevational view of the adapter and  
18 housing assembly depicted in FIG. 11;  
19          FIG. 12 is a fragmentary view of the vacuum cleaner  
20 base illustrating the drive module and air flow  
21 therethrough; and  
22          FIG. 13 is a partially cross-sectional view of the  
23 handle assembly.

24                           DESCRIPTION OF THE PREFERRED EMBODIMENTS

25          Referring to FIGS. 1, 1A, 1B and 3, a preferred  
26 embodiment vacuum cleaner 10 in accordance with the present  
27 invention is illustrated. The vacuum cleaner 10 comprises  
28 a rear housing 20, an upper front cover 30, a bag cover 80,  
29 and a lower motor cover 50 that generally form the body of  
30 the vacuum cleaner 10. The lower portion of the preferred  
31 embodiment vacuum cleaner 10 comprises an upper base 40  
32 having a front guard 120 and a plurality of wheels  
33 including rear wheels 110. The upper portion of the  
34 preferred embodiment vacuum cleaner 10 further comprises a

1 handle 90, a grip 100, and a side mounted tool caddie  
2 insert 34. Disposed along the rear of the vacuum cleaner  
3 10 is a final filter 60.

4 Referring specifically to FIG. 1A, other components of  
5 the preferred embodiment vacuum 10 are as follows. The  
6 handle 90 is disposed between the front cover 30 and the  
7 upper portion of the rear housing 20. The handle 90  
8 preferably has an arcuate bend proximate to its upper  
9 distal end 91. The bend is such that the distal end 91 is  
10 directed toward the rear of the vacuum cleaner 10. The  
11 grip 100 is affixed to a handle cover 102 and this assembly  
12 is slidably mounted on the upper distal end 91 of the  
13 handle 90. Various switches and controls may also be  
14 provided proximate to the distal end 91 of the handle 90  
15 such as, but not limited to, a neutral lock mechanism 130  
16 and related selector springs 132 and a selector spacer 134.  
17 In addition, one or more switches may be located at the  
18 distal end 91 of the handle 90 for controlling the  
19 operation of the vacuum cleaner 10. Other controls such as  
20 an on/off switch 140 and various potentiometer type  
21 controls such as a slide control 142 are preferably  
22 disposed and affixed to the front cover 30.

23 The upper base 40 and a lower base 180 engage each  
24 other and generally form a lower enclosure that houses the  
25 drive motor and brush assembly as follows. A drive motor  
26 230 is disposed and retained within the enclosure formed by  
27 the upper base 40 and the lower base 180. The drive motor  
28 230 is operatively coupled to a transmission 240 that also  
29 resides within the enclosure formed by the upper and lower  
30 bases 40 and 180. Rotatably secured to, or retained  
31 within, the lower base 180 are a plurality of wheels. A  
32 pair of rear wheels 110 are rotatably affixed to the lower  
33 base 180 by respective axles 111. Disposed proximate the  
34 front of the lower base 180 is a wheel carriage 112 that  
35 rotatably supports a front axle 116 having a pair of front  
36 wheels 114 secured at its ends. Also disposed within the  
37 enclosure formed by the upper base 40 and the lower base



1 180 is a rotatable brush or disturbulator 170. The  
2 disturbulator 170 is rotated by a disturbulator belt 172.  
3 A belt cover 174 is utilized to cover the belt 172.

4 Referring further to FIG. 1A, preferably disposed  
5 proximate to the lower portion of the rear housing 20 are a  
6 suction motor 210 and a motor shroud 220. The suction  
7 motor 210 draws air through the enclosure formed by the  
8 upper and lower bases 40 and 180, i.e. in the vicinity of  
9 the disturbulator 170, through a lower hose 72, a nested  
10 wand 78, an upper hose 70, a bag filter 270 disposed within  
11 a bag chamber described below, a second filter 260, an air  
12 intake duct 250, through the motor shroud 220 and  
13 eventually into the final filter 60 as described in greater  
14 detail below. A single screw is utilized for engaging the  
15 lower hose 72 connector to the lower base 180. A hose  
16 union 74 and other conventional coupling assemblies may be  
17 used to complete the airway. A unique releasably locking  
18 hose adapter 71, described in greater detail below, is  
19 preferably utilized to couple the upper hose 70 to the bag  
20 chamber within the rear housing 20.

21 An electrical power cord 200 and one or more cord  
22 release members 202 are provided along the rear of the  
23 vacuum cleaner 10. The power cord 200 provides electrical  
24 power to the suction motor 210 and the drive motor 230.  
25 The preferred embodiment vacuum cleaner 10 also comprises a  
26 headlight 150 and a lens 152 disposed in or upon the motor  
27 cover 50. A height adjustment assembly and knob 160 is  
28 provided for the lower base unit.

29 The preferred embodiment vacuum cleaner also comprises  
30 a variety of cleaning tools or attachments. A side mounted  
31 tool caddie insert 34 is preferably utilized to releasably  
32 retain these tools such as for instance a crevice tool 190,  
33 an upholstery nozzle 192, and a brush 194. An extension  
34 wand 76 is also provided. An attachment tool is utilized  
35 by detaching the hose 70 from the nested wand 78 at their  
36 coupling along the rear of the vacuum cleaner 10, as best  
37 depicted in FIG. 3. Upon release of the hose 70 from the

1 nested wand 78, one of the previously noted tools 190, 192,  
2 or 194, or the extension wand 76 can be attached to the  
3 free end of the hose 70.

4 Referring to FIG. 1B, another aspect of the preferred  
5 embodiment vacuum cleaner 10 is the orientation of the  
6 upper housing and handle 90 to the base when the vacuum  
7 cleaner 10 is in its stationary upright position. This  
8 position is reached when the vacuum cleaner is placed in  
9 its accessory vacuuming mode. As evident in FIG. 1B, the  
10 upper housing is preferably oriented forward at some angle  
11 X from vertical. This orientation results in a more stable  
12 assembly than if the upper housing were oriented along a  
13 generally vertical axis. This becomes increasingly  
14 important as the bag filter 270 (shown in FIG. 1A) fills up  
15 with dirt and debris, thereby increasing in weight. It is  
16 most preferred that the angle X be about 8-1/2°. The  
17 present invention vacuum cleaners include other  
18 configurations in which the upper housing and handle are  
19 angled forward.

20 Referring further to FIG. 1A, a conventional handle  
21 release 92 and a release spring 94 control the angular  
22 orientation of the upper portion of the vacuum cleaner  
23 housing and handle. The handle 90 and related attachments  
24 such as switches and grips, may be entirely detachable from  
25 the vacuum cleaner 10, or designed to pivot so that the  
26 assembly may be folded downward toward the floor to a  
27 horizontal, or substantially horizontal, position. It is  
28 also contemplated that the handle could be mounted within  
29 the upper portion of the vacuum cleaner body in such a way  
30 that the handle becomes the movable portion or actuator  
31 utilized to control the operation of the vacuum cleaner.  
32 This would eliminate providing selector controls at the end  
33 of the handle 90 such as the selector 130. In this  
34 contemplated embodiment, the linkage connection to the  
35 control cable, i.e. a sheathed transmission shifting cable  
36 described below, would occur within the top portion of the  
37 vacuum cleaner body or housing. In many or all of these

1   embodiments, it is further contemplated that the handle 90  
2   could be designed so that it could be readily removed from  
3   the main housing of the vacuum cleaner. This would  
4   significantly reduce the size of the shipping carton and  
5   reduce shipping costs. Other advantages would likely  
6   include quick customer assembly and reduction in the number  
7   of parts and parts costs. A reduction in the size of  
8   shipping carton and parts would further allow the packaged  
9   product to be more easily displayed in the sometimes  
10  restricted shelf area found in many retail stores.

11       It is also preferred to utilize a tilt switch,  
12  preferably disposed within the handle 90, that prevents  
13  operation of the drive motor 230 depending upon the  
14  position of the handle. Preferably, the switch opens or  
15  closes an electrical control circuit depending upon the  
16  angular orientation of the handle. A switch comprising a  
17  ball bearing and raceway is disposed within the handle 90  
18  and oriented such that when the handle is in an upright  
19  position, the ball bearing rolls or otherwise moves to a  
20  location along the raceway that results in an open  
21  electrical circuit between the switch terminals. The  
22  switch is also oriented so that when the handle is at any  
23  other position than its upright position, i.e. and so  
24  typically at some angle of inclination, the ball bearing  
25  rolls or moves to a location along the raceway that results  
26  in completion of the electrical pathway between the switch  
27  terminals. The tilt switch is preferably utilized in a  
28  control circuit governing operation of the drive motor 230  
29  so that when the handle is in its upright position, the  
30  drive motor 230 will not operate. It is also contemplated  
31  that other types of switches utilizing other types of  
32  movable elements could be used. Furthermore, other types  
33  of interlocking switches could be used to prevent operation  
34  of the drive motor 230 when the handle 90 is in its upright  
35  position. It is envisioned that electrical contacts could  
36  be provided between the tiltable body portion of the vacuum  
37  cleaner and the base portion. The electrically conductive

1 contacts would contact one another only when the handle was  
2 tilted from its upright position. The contacts would be  
3 incorporated into an electrical control circuit governing  
4 operation of the drive motor 230. Moreover, the location  
5 and placement of the switch could be elsewhere besides the  
6 handle, such as for instance, within the housing or base  
7 units of the vacuum cleaner.

8 The various housing, cover, and base components  
9 described herein can be formed from a wide array of  
10 materials. A preferred material is molded polyurethane.

11 The preferred embodiment vacuum cleaner 10 utilizes a  
12 unique and novel filtered airflow system as follows.  
13 Referring to FIG. 2, upon operation of the suction motor  
14 210 generally disposed within the motor shroud 220, air is  
15 drawn through the hose 70 and through the hose adapter 71  
16 into the bag filter 270. After passing through the walls  
17 of the bag filter 270, shown as arrow A in FIG. 2, air  
18 enters a secondary filter 260 located at the inlet of the  
19 air intake duct 250. Air passes through the air intake  
20 duct 250 shown as arrow B until it exits the duct 250 at  
21 the outlet shown as arrow C. The air then enters the inlet  
22 of the motor shroud 220, shown as arrow D, and then is  
23 directed through the outlet of the motor shroud 220 shown  
24 as arrow E. The air is then directed to the final filter  
25 60 as shown by arrow F. After passing through the final  
26 filter 60, the air then exits the vacuum cleaner 10 through  
27 laterally oriented airflow openings along the side of the  
28 final filter 60 and described in greater detail below. The  
29 air exits as shown as arrows G.

30 A bag chamber, i.e. an interior region that houses the  
31 bag filter 270, is formed between the rear housing 20 and  
32 the bag cover 80. During operation of the vacuum cleaner  
33 10, the bag chamber is usually at a negative pressure, i.e.  
34 a pressure less than atmospheric pressure.

35 The preferred embodiment motor shroud 220 generally  
36 encloses the suction motor 210 and diverts all air through  
37 the final filter 60. This configuration greatly simplifies

1 gasket design and sealing issues otherwise encountered if a  
2 multi-component housing or shroud assembly was used.  
3 Although a one-piece sealed shroud enclosing the suction  
4 motor is preferred, the present invention includes  
5 additional embodiments including the use of a by-pass duct  
6 located either upstream, downstream, or on both ends of the  
7 suction motor. Other sealed enclosures are contemplated  
8 wherein the sealing is accomplished by conventional  
9 gaskets, adhesives or component welding.

10 In a most preferred embodiment, air leaks are  
11 significantly reduced by recirculating airflow within the  
12 vacuum cleaner housing. Specifically, provisions are made  
13 to prevent exhaust air leaks from escaping to the  
14 environment before passing the air through the final filter  
15 60. This is accomplished by maintaining a negative  
16 pressure inside the vacuum cleaner housing, and  
17 particularly within the enclosure formed between the rear  
18 housing 20 and the bag cover 80. This region of negative  
19 pressure may also extend in the vicinity behind the front  
20 cover 30. Referring to FIGS. 2A and 2B, it is most  
21 preferred to use an ungasketed joint between the air duct  
22 250 and a mounting shelf 252 provided in the rear housing  
23 20. The mounting shelf 252 defines an opening sized to  
24 accept and preferably support an end of the air duct 250.  
25 The interface between the opening and the outer periphery  
26 of the air duct 250 is shown in FIGS. 2A and 2B as  
27 interface 251. This interface is most preferably not  
28 sealed. As a result, exhaust leaks occurring in and around  
29 the upper portion of the air duct 250 are drawn into the  
30 bag chamber. Similarly, by providing an ungasketed joint  
31 between the lower region of the air intake duct 250 and the  
32 inlet of the motor shroud 220, shown in FIG. 2B as joint  
33 224, potential exhaust leaks in and around a gasketed  
34 joint between the lower portion of the air duct 250 and the  
35 suction motor 210 are drawn back into the motor shroud 220.  
36 As can be seen, potential exhaust leaks from the positive  
37 pressure side of the air handling system are recaptured

1 into the airstream instead of being exhausted to the  
2 environment before passing the airstream through the final  
3 filter 60. This is achieved by maintaining a negative  
4 pressure inside the body or housing of the vacuum cleaner  
5 10. The negative pressure inside the body or housing is  
6 due to inherent and/or predetermined leaks between the  
7 various airflow handling components which allow air to  
8 enter the air intake duct 250 and the bag chamber.

9 In another preferred embodiment, a flexible conduit  
10 shown in FIG. 2A as conduit 253 is provided between the  
11 motor bearings and the suction side or negative pressure  
12 side of the system. The conduit and resulting air flow  
13 through the conduit captures particles and contaminants  
14 otherwise leaking through the bearing or around the bearing  
15 and into the atmosphere. In the absence of such conduit,  
16 particles and contaminants leak from inside the enclosure  
17 or motor shroud to the outside environment. Another  
18 advantage of providing the flexible conduit 253 is that the  
19 resulting airflow therethrough draws air through and around  
20 the bearing thereby cooling the bearing and neighboring  
21 components. Preferably and with reference to FIGS 2A and  
22 8, the conduit 253 extends from a collar 590 disposed  
23 proximate a motor bearing. The conduit 253 extends to a  
24 location of lesser pressure, such as within the air duct  
25 250. Other installation sites for the end of the conduit  
26 253 may be utilized instead of the air duct 250. For  
27 instance instead of terminating the end of the conduit 253  
28 at the air duct 250, that end could be installed on the  
29 shelf 252 so that the conduit 253 is in communication with  
30 the region of the enclosure behind the filter wall 300.

31 The preferred embodiment vacuum cleaner 10 utilizes a  
32 HEPA-rated final filter 60 best shown in FIGS. 4, 4A, 5, 6,  
33 and 7. The HEPA filter captures at least 99.97% of  
34 particles having a diameter of about 0.3 microns. The rear  
35 housing 20 is particularly adapted for accommodating the  
36 final filter 60. The rear housing 20 preferably comprises  
37 a rear wall 390 disposed between transversely extending

1 first and second sidewalls 310 and 320, respectively. A  
2 bottom arcuate wall 360 is provided that generally extends  
3 in the same direction as the sidewalls 310 and 320.  
4 Defined generally within the center of the rear wall 390 is  
5 an opening 380 through which exiting air passes into the  
6 final filter 60. The final filter 60 is detachably  
7 retained along the rear of the rear housing 20. The final  
8 filter 60 is preferably supported by a support ledge 370.

9 The rear housing 20 further includes a filter wall 300  
10 that partitions the interior of the vacuum cleaner 10, i.e.  
11 the bag chamber, from the final filter 60. Referring to  
12 FIG. 2A, the filter wall 300 segregates the filter 60,  
13 disposed on the rear face of the rear housing 20, from the  
14 bag chamber generally defined between the sidewalls 310,  
15 320 and the shelf 252. FIG. 2B is similar to FIG. 2A but  
16 illustrates the assembly with the filter wall 300 removed.  
17 Other structural aspects of the rear housing 20 are  
18 illustrated in FIGS. 2A and 2B. One or more support ribs  
19 312 and 322 may be provided along either or both of the  
20 side walls 310 and 320. One or more fastening bosses 330  
21 are also provided for threadedly engaging fasteners or  
22 releasable clips that may be used for securing the motor  
23 cover 50, the bag cover 80, or the front cover 30 to the  
24 rear housing 20.

25 Specifically referring to FIGS. 5 and 6, the preferred  
26 embodiment final filter 60 generally comprises a filter  
27 outer cover plate 400 disposed between a plurality of  
28 transversely extending walls such as a first side wall 410,  
29 a second side wall 420, a top wall 430, and a bottom wall  
30 440. A peripheral skirt 450 extends around the perimeter  
31 of the final filter 60 and provides a mounting lip or seat  
32 for sealing against the rear housing 20 when the final  
33 filter 60 is attached to the rear of the vacuum cleaner 10.  
34 A plurality of airflow openings 460 are defined along the  
35 lateral regions of the final filter 60. The final filter  
36 60 may also comprise one or more bottom legs 470 that  
37 engage the rear housing 20 of the vacuum cleaner 10 when

1 the final filter 60 is attached to the vacuum cleaner 10.  
2 A retaining member 480 is preferably utilized to assist in  
3 releasably retaining the final filter 60 to the vacuum  
4 cleaner 10. A filter element 490 such as a paper filter  
5 element, is disposed within the enclosure formed by the  
6 outer cover plate 400 and the walls 410, 420, 430, and 440.  
7 Referring to FIG. 7, during operation of the vacuum  
8 cleaner 10, air exiting the rear housing 20 flows through  
9 the filter element 490 and out of the final filter 60, i.e.  
10 through the airflow openings 460, which direct the air  
11 laterally outward. The airflow openings 460 are defined  
12 along the sidewalls 410 and 420. This is desirable,  
13 particularly when the vacuum cleaner 10 is in a fully  
14 reclined position such that its upper housing and handle  
15 are angled downward and near the floor 2. The laterally  
16 oriented openings 460 direct the exiting air stream away  
17 from the floor 2. The extent of reclining may be such that  
18 the handle is approximately horizontal. This orientation  
19 is useful so that the vacuum cleaner 10 has a low profile  
20 to thereby enable the vacuum cleaner to be used under  
21 furniture items and beds.  
22 The separate and detachable final filter 60 offers  
23 additional advantages. By using an external one-piece  
24 final filter assembly, there is no need for a separate  
25 housing or cover to house and protect the filter element.  
26 Furthermore, by utilizing a curved configuration for the  
27 outer cover plate 400 of the final filter 60, exiting air  
28 is directed slightly upwards from the floor 2 when the  
29 vacuum cleaner is in a fully reclined position. This  
30 further minimizes debris on the carpet from being blown  
31 with the air. This is illustrated in FIG. 7. The rear  
32 cover plate 400 further acts as a shield to protect the  
33 paper filter element 490 and further deaden noise. In yet  
34 another embodiment, some of the various laterally disposed  
35 airflow openings 460 located along both sides of the final  
36 filter 60 can be eliminated and defined on only one side of  
37 the filter housing.



1           Referring to FIGS. 8, 9, and 10, the motor shroud 220  
2   and suction motor 210 are illustrated in greater detail.  
3   The motor shroud 220 generally encloses the suction motor  
4   210. The motor shroud 220 is preferably cylindrical,  
5   comprising an arcuate wall 540 and an endwall 544. The  
6   motor shroud 220 comprises a tangentially and outwardly  
7   extending air duct 530 defining a shroud opening 510 at its  
8   distal end 531. The air duct 530 is in airflow  
9   communication with the final filter 60 disposed behind the  
10  filter wall 300 as shown in FIG. 2A. The air duct 530 may  
11  be attached to the mounting shelf 252. Preferably provided  
12  proximate to the distal end 531 of the air duct 530 is a  
13  seal seat 532. The seal seat 532 supports a pliable and  
14  flexible seal 520 that reduces air leaks between the  
15  mounting shelf 252 and the air duct 530 of the motor shroud  
16  220. One or more fasteners 570 and bosses 560 are used to  
17  affix and secure the assembly. A sealing and coupling  
18  ring 580 is preferably used between the suction motor 210  
19  and the shroud 220. The assembly of the motor 210, the  
20  ring 580, and the shroud 220 is preferably disposed within  
21  the lower portion of the rear housing 20, and as best shown  
22  in FIG. 2A, against the second sidewall 320 of the rear  
23  housing 20. Most preferably, the assembly is  
24  concentrically aligned with the pivot hub 350 defined in  
25  that sidewall. An alignment and support collar 590 is  
26  preferably utilized, as shown in FIG. 8 to facilitate  
27  support and engagement between the shroud 220 and the pivot  
28  hub 350 in the second sidewall 320.

29       The motor shroud 220 utilizes an interior isolation  
30  wall 500 as shown in FIG. 10. The isolation wall 500  
31  generally blocks access to electrical components of the  
32  suction motor 210 and serves as a sound insulating barrier  
33  to decrease motor noise. Referring also to FIG. 9, the  
34  motor shroud 220 also provides one or more terminal  
35  apertures 550 that provide access to one or more electrical  
36  terminals 212 of the suction motor 210. The preferred  
37  embodiment for forming a seal between the motor terminals

1 212 and the housing of the shroud 220 is by utilizing die  
2 cut or molded rubber or plastic members that create a seal  
3 within the motor terminal area. This prevents the motor  
4 exhaust air escaping through the shroud 220. The present  
5 invention includes other embodiments for sealing the region  
6 between the motor terminals 212 and the shroud 220 such as,  
7 but not limited to, the following. A seal may be formed in  
8 this interface region by utilizing a liquid material such  
9 as a flowable adhesive, a hot melt adhesive, and silicone  
10 sealing materials as known in the art which fill the  
11 openings before curing to a hardened state. Alternatively,  
12 or in addition, a seal may be formed by utilizing a tight  
13 interference fit between the motor terminals 212 or their  
14 base, and openings within the motor shroud 220 such as the  
15 apertures 550. Alternatively, or in addition, a seal may  
16 be formed by insert molding terminals or wires into the  
17 motor shroud 220 which can then be electrically connected  
18 to the motor terminals 212. Furthermore, a seal may be  
19 formed by utilizing a tight interference fit between  
20 generally round holes in the motor shroud 220 and wires  
21 which connect to the motor terminals 212. It is to be  
22 understood that any combination of the foregoing sealing  
23 techniques may be used.

24 The preferred embodiment vacuum cleaner 10 also  
25 comprises a thermal cutoff assembly 221 (FIG. 8) utilizing  
26 a temperature sensitive safety switch that terminates  
27 operation of the suction motor 210 is an excessively high  
28 temperature is sensed. The motor 210 cannot be restarted  
29 until the switch and sensing unit cool and the electrical  
30 circuit is broken and connected again, i.e. the switch is  
31 reset. That is, both cooling and reset must occur before  
32 the motor 210 can be restarted. The thermal cutoff  
33 assembly 221 comprises a switching element having a  
34 positive temperature coefficient characteristic. The  
35 switching element is preferably mounted on the shroud 220  
36 of the suction motor 210 and is wired in series therewith  
37 to automatically shut off the motor 210 if excessively high

1 temperatures are sensed or an overheat condition occurs.  
2 Overheating may occur if one or more of the filters 270,  
3 260 or 60 become blocked or excessively plugged, thereby  
4 hindering or precluding airflow past the suction motor 210.  
5 The motor 210 cannot be restarted until the switching  
6 element cools and the electrical circuit is re-established.  
7 The electrical circuit is re-established in one of several  
8 ways such as by unplugging the vacuum cleaner or turning  
9 the power switch off, and then either plugging in the  
10 vacuum cleaner or turning the power switch on. The  
11 positive temperature coefficient characteristic of the  
12 switching element provides an advantage over conventional  
13 manual reset thermal cutoff assemblies in that it  
14 simplifies the design and eliminates parts otherwise  
15 required such as a restart button and related wiring.

16 Most preferably, the thermal cutoff assembly comprises  
17 a positive temperature coefficient resistor and a reset  
18 component. The positive temperature coefficient resistor  
19 is adapted to switch, at a predetermined temperature such  
20 as indicative of overheating or a clogged filter, from a  
21 low resistance to a very high resistance. When the  
22 positive temperature coefficient resistor switches to a  
23 high resistance, the cutoff assembly cuts off electric  
24 power to the motor assembly. The reset component prevents  
25 the restoration of power to the motor assembly until  
26 electric power is disconnected from the cutoff assembly,  
27 such as by unplugging the unit or turning the power switch  
28 off, and the positive temperature coefficient resistor  
29 changes back to a low resistance while the unit is  
30 disconnected. The change to a low resistance occurs as a  
31 result of sufficient cooling of the positive temperature  
32 coefficient resistor. Only then may electric power be  
33 directed to the motor.

34 The preferred embodiment vacuum cleaner 10 utilizes a  
35 reliable mounting configuration and technique for attaching  
36 the handle 90 to the upper portion of the vacuum cleaner  
37 10. Referring to FIG. 1A, the handle 90 is mounted between

1 the upper portion of the rear housing 20 and the front  
2 cover 30. Specifically, the lower region of the handle  
3 proximate to a lower distal end 95 is placed within a  
4 handle cradle 24 provided on the upper interior surface of  
5 the rear housing 20. One or more outwardly extending  
6 mounting posts 26 are provided, preferably along the length  
7 of the mounting cradle 24. It is also preferred to provide  
8 a mounting post 26 at the uppermost region of the rear  
9 housing 20 to further secure the handle 90. One or more  
10 mounting apertures 96 are defined along the lower portion  
11 of the handle 90 such that when the handle 90 is placed  
12 within the cradle 24, the mounting posts 26 are aligned  
13 with the apertures 96 and extend therein. The handle 90 is  
14 secured to the rear housing 20 by attaching the rear cover  
15 30 over the handle 90 disposed and aligned within the  
16 cradle 24. It is also contemplated that a similar cradle  
17 may be provided on the interior surface of the front cover  
18 30, preferably with mounting posts that would engage  
19 additional mounting apertures defined in the handle 90.

20 The preferred embodiment vacuum cleaner 10 utilizes a  
21 transmission control cable configuration substantially as  
22 shown in U.S. Patent no. 4,249,281. Referring to FIGS. 1A,  
23 2B, and 13, it will be noted that the transmission neutral  
24 lock mechanism 130 is disposed on the handle 90 and the  
25 transmission 240 is disposed within the upper and lower  
26 bases 40 and 180, respectively. The handle assembly  
27 comprising the cover 102 and the grip 100 is preferably of  
28 a plastic material and is clamped together by means of  
29 screws 950 and 952. For this purpose suitable slots 954  
30 may be provided on opposite sides of the upper end 91 of  
31 the handle 90 through which losses 956 and 958 extend to  
32 engage one another. This mounting thereby covers the upper  
33 end of the handle 90 and inhibits removal of the handle  
34 assembly therefrom and yet permits the handle assembly to  
35 move slidably axially at the end of the handle 90. This  
36 mounting of course also inhibits relative rotation between  
37 the handle assembly and the handle 90.

1           A further slot 960 is provided extending axially and  
2 adjacent the end 91 of the handle 90 and a boss 962 extends  
3 centrally into this slot from the handle cover 102.  
4 Helical springs 132 are affixed to opposite sides of the  
5 boss 962 and extend in opposite directions for connection  
6 to the insides of the handle 90 at opposite ends of the  
7 slot 960. The springs 132 serve to hold the handle  
8 assembly at a central position with respect to the slot  
9 960, while permitting resilient movement back and forth  
10 therefrom, depending upon the forces applied to the handle  
11 assembly.

12           In addition, an axially extending slot 964 may be  
13 provided at one end of the handle assembly, with a groove  
14 966 underlying the slot 964 and having somewhat greater  
15 dimensions. The mechanism 130 is slidably mounted with an  
16 enlarged base in the groove 966 and a push-button end  
17 extending through the slot 964. A leaf spring 968 extends  
18 in the groove 966 between the handle 90 and the mechanism  
19 130, and has one end thereof fixed with respect to the  
20 cover 102, for example by extending into a radially  
21 outwardly extending aperture 970 at the end of the groove  
22 966. The other end of the leaf spring 968 is formed with a  
23 projection 972 toward the handle 90, the projection 972  
24 being aligned with a hole 974 in the wall of the handle 90  
25 in the central or neutral position of the handle assembly.  
26 The spring 978 is normally biased away from the hole 974,  
27 with the button in pocket of the slot, but when the button  
28 is depressed and urged to a forward position it depresses  
29 the spring 978 so that the projection 972 enters the hole  
30 974, to inhibit relative sliding movement of the handle  
31 assembly with respect to the handle 90 from the neutral  
32 position.

33           Still referring to FIG. 13, the Bowden wire 131  
34 extends to a suitable clamp 980 adjacent the upper end of  
35 the handle assembly. A central wire 982 of the cable has  
36 an enlarged upper end 984 which is restrained at the end of  
37 the handle assembly. As a consequence, forward or rearward

1 movement of the handle assembly will cause the central wire  
2 982 to slip forwardly and rearwardly within the outer  
3 sheath.

4 The sheathed cable extends from the selector 130  
5 downward through the handle 90 and into the upper portion  
6 of the vacuum cleaner 10, i.e. between the rear housing 20  
7 and the front cover 30. The sheathed cable extends further  
8 toward the bottom portion of the rear housing 20, and  
9 particularly proximate to the pivot hub 350 provided on the  
10 first side wall 310 of the rear housing 20. The sheathed  
11 cable extends through its pivot hub 350 and into the base  
12 of the vacuum cleaner 10. The cable is connected to a  
13 transmission shifting yoke that utilizes a linearly  
14 displaceable shifting member which effects shifting to the  
15 transmission 240. The active or movable end of the cable  
16 is attached to the shifting member and the end of the  
17 sheath is attached to a stationary support post provided in  
18 the vicinity of the shifting member. In the assembled  
19 vacuum cleaner 10, movement of the selector 130 is  
20 transmitted to the displaceable shifting member by the  
21 control cable.

22 The present invention vacuum cleaner 10 utilizes an  
23 elegant locking and affixment configuration between the  
24 upper hose 70 and the upper portion of the vacuum cleaner  
25 10. FIG. 11 is a detail of the hose adapter 71 and its  
26 engagement with the upper portion of the rear housing 20.  
27 As shown in FIG. 1A, the hose adapter 71 is disposed  
28 between the upper hose 70 and the rear housing 20.  
29 Referring to FIGS. 11 and 11A, the hose adapter 71  
30 preferably comprises an inclined lip or flange 600  
31 extending around at least a portion of the outer periphery  
32 of the adapter 71. The lip 600 has an inclined or ramped  
33 region designated herein as a cam region 610. The distal  
34 end 630 of the hose adapter 71 is inserted within an  
35 opening 660 defined in a support ledge 620, generally  
36 provided along the interior facing side of the rear housing  
37 20. The bag filter 270 is attached to the end 630 by

1 fitting the end 630 into an aperture 270A in a mounting  
2 plate 270B provided at the top of the filter 270. The  
3 mounting plate is retained between the support ledge 620  
4 and a parallel ledge 620A. The opening 660 may be an  
5 aperture of circular shape, or may be in the form of a  
6 notched passageway defined in the support of ledge 620.  
7 One or more support ribs 650 may be provided to strengthen  
8 the attachment between the lip 600 and the hose adapter 71.  
9 The hose adapter 71 is releasably engaged with the rear  
10 housing 20 by positioning it over the opening 660 such that  
11 the lip 600 is disposed underneath a locking ledge 640.  
12 That is, a portion of the lip 600 is disposed between the  
13 locking ledge 640 and the support ledge 620. The hose  
14 adapter 71 is then rotated, which due to the action of the  
15 inclined cam region 610, induces downward displacement of  
16 the hose adapter 71, and specifically the distal end 630,  
17 into the opening 660. The lip 600 defines an arcuate edge  
18 604 extending around at least a portion of the hose adapter  
19 71. It is preferred to provide a flat region 602 such that  
20 when the hose adapter 71 is locked into place upon the  
21 support ledge 620, the flat edge 602 is flush, or at least  
22 not extending beyond, an outer edge 622 of the support  
23 ledge 620. The arcuate edge 604 of the lip 600 preferably  
24 extends radially outward from the hose adapter 71 a  
25 distance such that when the adapted 71 is not locked into  
26 place, i.e. and so that the flat edge 602 is not flush with  
27 the outer edge 622 of the support ledge 620, the arcuate  
28 edge 604 extends outward beyond the edge 622. This  
29 prevents the bag cover 80, or other housing component, from  
30 being fully engaged with the rear housing 20. This unique  
31 interlock configuration requires that the upper hose 70 be  
32 properly coupled to the housing of the vacuum cleaner 10.

33 The preferred embodiment vacuum cleaner 10 also  
34 utilizes a single wheel drive mechanism. The use of a  
35 single wheel drive mechanism offers improved  
36 maneuverability, a more economical and less expensive drive  
37 assembly, simplicity of engaging the transmission to the

1 chassis, versatility of location relative to the cleaning  
2 head or base, and improved serviceability for the vacuum  
3 cleaner.

4 The drive assembly and related gear cluster is  
5 preferably of the type disclosed in U.S. Patent 4,249,281  
6 to Meyer et al., which is herein incorporated by reference.  
7 Furthermore, it is contemplated that the drive motor used  
8 in the preferred embodiment vacuum cleaner 10 could be of  
9 the variable speed type, controlled by an electronic  
10 module, which may be in the form of a diode in series or a  
11 potentiometer. This would enable the drive speed to be  
12 operator adjustable for the pace desired by each individual  
13 user of the vacuum cleaner 10.

14 As may be seen most clearly in FIG. 12, the single  
15 wheel drive mechanism comprising the drive motor 230, the  
16 transmission 240, and associated gear cluster and single  
17 drive wheel preferably disposed and mounted within the  
18 lower base 180. Mounting provisions may be provided on a  
19 side region of the lower base 180, such as the left hand  
20 side of the lower base 180 illustrated in FIGS. 1A and 12.  
21 A drive shaft is used to couple the single drive wheel 241  
22 to the other components of the drive mechanism. Various  
23 supporting and mounting provisions can be provided in the  
24 lower base 180 for rotatably securing the drive shaft and  
25 single drive wheel to the lower base 180. Preferably in  
26 this regard, an "eyebrow" notch is formed in a vertical  
27 wall or rib in the lower base 180, through which the drive  
28 shaft passes. The shaft may be further supported by a  
29 bearing disposed within the notch.

30 It is also contemplated to utilize a clutch in the  
31 drive mechanism. A problem encountered in self-propelled  
32 vacuum cleaners is fracturing or breaking or other failures  
33 in the weakest component in the gear chain. This often  
34 results during unpowered, rolling transport of the vacuum  
35 cleaner, when the user has failed to place the drive  
36 mechanism in neutral. Under these conditions, torque  
37 generated by the drivewheel rolling across the floor is



1 transmitted through the drive axle to the transmission and  
2 eventually to the drive motor. In the event the total gear  
3 reduction is relatively high, so that the drive motor will  
4 tend to not turn, the weakest component in the gear chain  
5 will fail. In order to remedy this problem, a one-way  
6 clutch is added to the drive train to disconnect the torque  
7 between the transmission and the drive module gear  
8 reduction assembly or drive motor.

9 The drive mechanism utilized in the preferred  
10 embodiment vacuum cleaner 10 is assembled by utilizing a  
11 unique technique for achieving proper spacing between the  
12 legs of a yoke and the drive gear cluster. Referring to  
13 the noted U.S. Patent 4,249,281, and particularly to FIGS.  
14 5 and 6 of that patent, a yoke 120 generally encloses the  
15 gear cluster. As described in that patent, a plurality of  
16 bearing rivets 130 are provided on downwardly extending  
17 arms 124 of the yoke 120. These rivets 130 are utilized to  
18 effect proper spacing between the yoke arms 124 and the  
19 gear cluster. Although the assembly described in the '281  
20 patent is satisfactory in many respects, the present  
21 invention provides an improved assembly that is  
22 significantly easier to assemble and eliminates the  
23 necessity for the bearing rivets 130.

24 As noted, it is important to achieve proper spacing  
25 between the ends of the gear cluster and arms of the yoke.  
26 In accordance with the present invention, one or more  
27 spacing washers are incorporated in the assembly. The  
28 width and placement of the washers are such that the gear  
29 cluster is placed into proper position with respect to the  
30 yoke arms. During assembly, the yoke and the gear cluster  
31 are introduced into a machine that automatically measures  
32 the total axial thickness of the gear cluster, and also  
33 measures the interior clearance or distance between the  
34 yoke arms. Using these two measured distances, one or more  
35 spacing washers are then dispensed and preferably  
36 appropriately incorporated into the gear cluster to arrive  
37 at a proper spacing between the gear cluster and yoke arms.

1           Proper neutral adjustment is preferably accomplished  
2 by utilizing one or more spacers, i.e. spacing shims, that  
3 are inserted in or between a centering plate of the gear  
4 cluster. A single set screw, preferably extending through  
5 the yoke, is then tightened to lock the gear cluster, now  
6 in its spaced and neutral position, in place with the yoke.  
7 Upon incorporation into the vacuum cleaner, and connection  
8 to a Bowden wire or control cable 131, the shims are  
9 removed and the set screw loosened or also removed.

10           As further illustrated in FIG. 12, the drive motor 230  
11 and the transmission 240 are encased in a shroud 700.  
12 Carbon (or other) dust particles produced by the motor and  
13 transmission are prevented from escaping to the environment  
14 by providing a suction in the area of the drive motor to  
15 draw particles into the airflow which passes ultimately  
16 through the finial filter 60. The airflow over the drive  
17 motor and the transmission is drawn through openings in the  
18 shroud 700. This suction is provided by the vacuum motor  
19 210 that provides suction for cleaning as its primary  
20 function. According to a preferred embodiment a slot  
21 opening 702 is provided in the shroud 700 which  
22 communicates with the main floor nozzle chamber.

23           While the foregoing details are what is felt to be the  
24 preferred embodiments of the present invention, no material  
25 limitations to the scope of the claimed invention are  
26 intended. Further, features and design alternatives that  
27 would be obvious to one of ordinary skill in the art are  
28 considered to be incorporated herein. The scope of the  
29 invention is set forth and particularly described in the  
30 claims herein below.

1 WHAT IS CLAIMED IS:

1 1. A vacuum cleaner comprising:  
2 a rear housing having an upper portion, a middle  
3 portion, and a lower portion;  
4 an upper front cover engaged with said upper  
5 portion of said rear housing;  
6 a bag cover releasably engaged with said middle  
7 portion of said rear housing, wherein said bag cover and  
8 said rear housing define a suction chamber for enclosing a  
9 filter bag;  
10 a base unit providing a lower enclosure, said  
11 base unit pivotally secured to said rear housing;  
12 a motor and motor housing disposed within said  
13 base unit;  
14 a drive assembly disposed within said base unit  
15 and selectively coupled to said motor;  
16 a nested wand releasably retained along the  
17 exterior of said rear housing, said wand having an upper  
18 portion and a lower portion;  
19 a lower air conduit extending between said base  
20 unit and said lower portion of said nested wand; and  
21 an upper air conduit extending between said upper  
22 portion of said nested wand and said suction chamber.

1 2. The vacuum cleaner of claim 1, wherein said motor  
2 housing defines an aperture and said motor includes motor  
3 terminals accessible through said aperture, said vacuum  
4 cleaner further comprising;  
5 a power cord for providing electrical power to  
6 said motor, said power cord having a first end secured to  
7 said vacuum cleaner and a second end adapted for connecting  
8 to an electrical power source; and  
9 electrical conductors extending between said  
10 first end of said power cord and said motor terminals;  
11 wherein said motor housing includes a seal  
12 disposed in said aperture defined in said housing, said

13 seal being formed from a flexible and resilient material.

1           3. The vacuum cleaner of claim 1 wherein said motor  
2 housing includes (i) a tangentially and outwardly extending  
3 air duct projecting from said housing and (ii) an isolation  
4 wall disposed within said housing, said isolation wall  
5 positioned proximate to an entrance of said air duct  
6 thereby blocking access to said motor and serving as a  
7 sound insulating barrier.

1           4. The vacuum cleaner of claim 1 wherein said rear  
2 housing includes (i) a main panel, (ii) a support ledge  
3 projecting from said main panel of said rear housing, and  
4 (iii) a locking ledge also projecting from said main panel  
5 of said rear housing, said locking ledge spaced from said  
6 support ledge and oriented generally parallel to said  
7 support ledge, said locking ledge projecting over only a  
8 portion of said support ledge, thereby defining a remaining  
9 portion of said support ledge, said support ledge defining  
10 an aperture in said remaining portion, said vacuum cleaner  
11 further comprising;

12               a releasably locking hose adapter disposed  
13 between said upper air conduit and said suction chamber,  
14 said hose adapter comprising: (i) a cylindrical body  
15 insertable within said aperture defined in said support  
16 ledge, and (ii) a radially projecting lip extending around  
17 at least a portion of said cylindrical body, said lip being  
18 insertable between said locking ledge and said support  
19 ledge.

1           5. The vacuum cleaner of claim 1 wherein said rear  
2 housing is pivotable with respect to said base unit from an  
3 upright position wherein said rear housing is generally  
4 transverse to said base unit and oriented at an angle of  
5 about 8-1/2 degrees from vertical and disposed over said  
6 base unit, to a fully reclined position wherein said rear  
7 housing is approximately coplanar with said base unit.

1           6.    The vacuum cleaner of claim 1 wherein said rear  
2 housing is pivotable with respect to said base unit from an  
3 upright position to a fully reclined position, said vacuum  
4 cleaner further comprising;  
5               a handle projecting upward from said rear  
6 housing; and  
7               a tilt switch in electrical association with said  
8 motor wherein said tilt switch opens to break an electrical  
9 power circuit to said motor when said rear housing is  
10 placed in said upright position.

1           7.    The vacuum cleaner of claim 1 further comprising;  
2               a handle projecting upward from said rear  
3 housing, said handle comprising a lower portion and an  
4 upper portion, said lower portion of said handle disposed  
5 between and contacting said upper front cover and said rear  
6 housing.

1           8.    The vacuum cleaner of claim 1 wherein said drive  
2 assembly includes a drive wheel operably coupled to said  
3 motor.

1           9.    The vacuum cleaner of claim 8 wherein said drive  
2 assembly further includes a clutch assembly operatively  
3 disposed between said drive wheel and said motor.

1           10.   A vacuum cleaner comprising:  
2               a lower base unit;  
3               an upper enclosure for housing a filter bag, said  
4 upper enclosure pivotable with respect to said lower base  
5 unit;  
6               a motor disposed within said lower base unit;  
7               a power cord having a first end affixed to at  
8 least one of said upper enclosure and said lower base unit,  
9 and a second end adapted for connecting to an electrical  
10 power source;

11           electrical conductors extending between said  
12 first end of said power cord and said motor, said  
13 electrical conductors defining an electrical power circuit  
14 to said motor; and  
15           a thermal cutoff assembly including a temperature  
16 sensor disposed proximate to said motor for measuring the  
17 temperature of said motor, said thermal cutoff assembly  
18 further including a switching element in electrical  
19 association with said electrical conductors, wherein upon  
20 said temperature sensor sensing a temperature greater than  
21 a predetermined temperature setpoint, said switching  
22 element opens said electrical power circuit.

1           11. The vacuum cleaner of claim 10 further  
2 comprising:  
3           a drive assembly disposed within said lower base  
4 unit and in operable engagement with said motor.

1           12. The vacuum cleaner of claim 10 wherein said upper  
2 enclosure defines an exhaust air opening, said vacuum  
3 cleaner further comprising:  
4           a secondary filter releasably retained along a  
5 rear face of said upper enclosure and in communication with  
6 said exhaust airflow opening.

1           13. The vacuum cleaner of claim 10 wherein said upper  
2 enclosure is pivotable with respect to said lower base unit  
3 from an upright position to a fully reclined position, said  
4 vacuum cleaner further comprising:  
5           a handle projecting upward from said upper  
6 enclosure; and  
7           a tilt switch in electrical association with said  
8 motor wherein said tilt switch opens said electrical power  
9 circuit to said motor when said upper enclosure is placed  
10 in said upright position.

1           14. The vacuum cleaner of claim 10 wherein said upper  
2 enclosure includes a front portion and a rear portion, said  
3 front and said rear portions when engaging each other  
4 define a handle aperture, said at least one of said front  
5 and said rear portions including a cradle structure, said  
6 vacuum cleaner comprising:

7           a handle member having a first end disposed in  
8 said cradle structure and disposed between said front and  
9 said rear portions of said upper enclosure, said handle  
10 extending through said handle aperture to a second end.

1           15. A vacuum cleaner comprising:  
2           a lower base unit;  
3           an upper enclosure for retaining a filter bag,  
4 said upper enclosure pivotable with respect to said lower  
5 base unit, said upper enclosure defining a suction chamber,  
6 an exhaust chamber, and an exhaust opening providing access  
7 from the exterior of said upper enclosure to said exhaust  
8 chamber,  
9           a motor and fan assembly disposed within said  
10 upper enclosure, said motor and fan assembly disposed in  
11 airflow communication between said suction chamber and said  
12 exhaust chamber; and  
13           a detachable filter assembly adapted to  
14 releasably engage said upper enclosure proximate said  
15 exhaust opening.

1           16. The vacuum cleaner of claim 15 wherein said upper  
2 enclosure includes a suction chamber inlet, a suction  
3 chamber outlet, and an exhaust chamber inlet, said vacuum  
4 cleaner further comprising:  
5           a motor housing within which is disposed said  
6 motor and fan assembly, said motor housing disposed in said  
7 upper enclosure and including an air intake duct in  
8 communication with said suction chamber outlet, and an air  
9 exhaust duct in communication with said exhaust chamber  
10 inlet;

11           a lower airflow conduit extending from and in  
12 communication with said lower base unit; and  
13           an upper airflow conduit assembly extending  
14 between said suction chamber inlet and a distal end of said  
15 lower airflow conduit.

1           17. The vacuum cleaner of claim 16 wherein said upper  
2 enclosure further includes a partitioning wall separating  
3 said suction chamber from a region of said upper enclosure  
4 within which is disposed said motor housing, said  
5 partitioning wall defining said suction chamber outlet,  
6 said air intake duct engaging said partitioning wall at  
7 said suction chamber outlet along an unsealed interface.

1           18. The vacuum cleaner of claim 16 wherein said air  
2 intake duct engages said motor housing along an unsealed  
3 interface.

4           19. The vacuum cleaner of claim 16 wherein said motor  
5 housing defines an aperture and said motor includes motor  
6 terminals projecting through said aperture, wherein said  
7 motor housing includes a seal disposed in said aperture and  
8 sealingly around said motor terminals, said seal being  
9 formed from a flexible and resilient material.

1           20. The vacuum cleaner of claim 16 wherein said motor  
2 housing includes an isolation wall disposed within said  
3 housing and proximate to an entrance of said air intake  
4 duct thereby blocking access to said motor and serving as a  
5 sound insulating barrier.

1           21. The vacuum cleaner of claim 16 wherein said motor  
2 housing includes a collar for retaining a bearing for said  
3 motor, said vacuum cleaner further comprising:  
4           an airflow conduit extending from said collar to  
5 said air intake duct.



1           22. The vacuum cleaner of claim 16 wherein said upper  
2 enclosure includes (i) a main panel, (ii) a support ledge  
3 projecting from said main panel, and (iii) a locking ledge  
4 also projecting from said main panel, said locking ledge  
5 spaced from said support ledge and oriented generally  
6 parallel to said support ledge, said locking ledge  
7 projecting over only a portion of said support ledge  
8 thereby defining a remaining portion of said support ledge,  
9 said support ledge defining said suction chamber inlet in  
10 said remaining portion, said vacuum cleaner further  
11 comprising:

12                 a releasably locking hose adapter disposed  
13 between said upper airflow conduit and said suction  
14 chamber, said hose adapter comprising (i) a cylindrical  
15 body insertable within said suction chamber inlet defined  
16 in said support ledge, and (ii) a radially projecting lip  
17 extending around at least a portion of said cylindrical  
18 body, said lip being insertable between said locking ledge  
19 and said support ledge.

1           23. A vacuum cleaner comprising:  
2                 a lower base enclosure;  
3                 an upper enclosure having internal walls dividing  
4 said upper enclosure into a suction chamber, and exhaust  
5 chamber, and a motor chamber;  
6                 a motor and fan assembly disposed in a shroud,  
7 said shroud disposed in said motor chamber of said upper  
8 enclosure;  
9                 an air intake duct extending between and in  
10 communication with said suction chamber and said shroud,  
11                 wherein said air intake duct engages at least one  
12 of (i) said wall defining said suction chamber along an  
13 unsealed interface, and (ii) said shroud along an unsealed  
14 interface.

1           24. A vacuum cleaner comprising:  
2                 a lower base enclosure having a first suction

3 chamber in contact with a floor to be cleaned,  
4 an upper enclosure having internal walls dividing  
5 said upper enclosure into a second suction chamber, an  
6 exhaust chamber, and a motor chamber;  
7 a drive module having a drive motor in said lower  
8 base enclosure, at least said drive motor being encased in  
9 a shroud;  
10 a passage between said drive module shroud and  
11 said second suction chamber.

1 25. The vacuum cleaner of claim 24 wherein said  
2 passage between said drive module shroud and said suction  
3 chamber includes a duct between said drive module shroud  
4 and said first suction chamber and further included a  
5 passage between said first suction chamber and said second  
6 suction chamber.

1 26. The vacuum cleaner of claim 23 further  
2 comprising:  
3 electrical conductors for providing electrical  
4 power to said motor, said electrical conductors defining a  
5 power circuit;  
6 a thermal cutoff assembly including a temperature  
7 sensor disposed proximate to said motor for measuring the  
8 temperature of said motor, said thermal cutoff assembly  
9 further including a switching element in electrical  
10 association with said electrical conductors, wherein upon  
11 said temperature sensor sensing a temperature greater than  
12 a predetermined temperature setpoint, said switching  
13 element opens said electrical power circuit and disables  
14 operation of said motor.

1 27. The vacuum cleaner of claim 23 wherein said  
2 shroud includes a collar for retaining a bearing for said  
3 motor, said vacuum cleaner further comprising:  
4 an airflow conduit extending from said collar to  
5 said air intake duct.

1           28. The vacuum cleaner of claim 23 wherein said upper  
2 enclosure includes a support ledge, a locking ledge spaced  
3 from said support ledge and oriented generally below and  
4 parallel to said support ledge, said support ledge defining  
5 an aperture, said vacuum cleaner further comprising:  
6           an upper airflow conduit assembly extending  
7 between said suction chamber and said lower base enclosure;  
8 and  
9           a hose adapter disposed between said upper  
10 airflow conduit and said suction chamber, said hose adapter  
11 comprising (i) a hollow member insertable within said  
12 aperture defined in said support ledge; and (ii) an  
13 outwardly projecting lip extending around at least a  
14 portion of the periphery of said hollow member, said lip  
15 being insertable between said locking ledge and said  
16 support ledge.

17           AIR FILTRATING SELF-PROPELLED UPRIGHT VACUUM CLEANER

18                           ABSTRACT

19           Disclosed is a unique and novel air filtrating, self-  
20 propelled upright vacuum cleaner. The filtration system  
21 utilizes a HEPA-rated air filter as a final filtering  
22 element. The disclosed vacuum cleaner contains numerous  
23 other features including a self-propelled drive mechanism.



Application No: GB 9726080.6  
Claims searched: 1 to 9

Examiner: Graham S. Lynch  
Date of search: 18 May 1998

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.P): A4F (FSCW, FSCA, FSCM, FSDM, FFE)

Int CI (Ed.6): A47L 5/28, 9/00

Other: None

**Documents considered to be relevant:**

Category	Identity of document and relevant passage		Relevant to claims
Y	GB 2291336	WHITE CONSOLIDATED. Figures 1 to 3. Page 5, line 6 to page 7, line 11.	1 to 3, 5, 7 to 9.
Y	EP 0453296	HITACHI. Note especially Figure 8, part 21 and column 7, lines 13 to 22.	3
Y	US 5584095	PHILIPS. Figures 1 to 3. Column 2, line 39 to column 4, line 7.	1 to 3, 5, 7 to 9.
Y	US 5553347	MATSUSHITA. Figures 1 and 2. Column 3, lines 26 to 47.	1 to 3, 5, 7 to 9.
Y	US 5115537	SCOTT FETZER CO. Column 1, lines 26 to 54.	8, 9

X Document indicating lack of novelty or inventive step  
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A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
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